DEVOTED EXCLUSIVELY TO METALLIC SURFACE TREATMENTS

METAL FINISHING

JULY, 1949 VOLUME 47 • NUMBER 7

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A critical survey of current practice for plating zinc die-castings, with comments on the various cycles used in commercial practice.

An article describing the important effects of adsorption on the surface of solid bodies, with special reference to utilization in cleaning and plating metals.

How an aircraft maintenance shop increased efficiency of their sand-blasting operations through the use of high air pressures.

A report of an extensive research on the deposition of copper from phosphoric acid baths.

Founded as Metal Industry, January, 1903
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Published Monthly by

FINISHING PUBLICATIONS, INC.

founded 1903 as
Metal Industry Publishing Co., Inc.
11 West 42nd St. New York 18, N. Y.
Telephone: PEnnsylvania 6-0226

Branch Offices
Chicago 11
612 N. Michigan Ave.
WHitehall 4-1920

Los Angeles 13
424 S. Broadway
MAdison 6-5421

also publishers of
Organic Finishing, monthly, $3.00 per year

Member

CCA NBP

National Conference of Business Paper Editors

Copyright 1949 by Finishing Publications, Inc. Entered February 25, 1903, at New York, N. Y., as second class matter under Act of Congress, March 3, 1879. Re-entered as second class matter June 13, 1940, at the post office at New York, N. Y., under the Act of March 3, 1879.

SUBSCRIPTION PRICES: United States, $4.00 and Canada $4.00 per year. Other countries $8.00. Single copies 45c in U. S. and Canada, Foreign 85c. Guidebook-Directory published as separate volume in pocket size form $1.50. 1948 edition current. Please remit by check or money order; cash should be registered.

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DEVOTED EXCLUSIVELY TO METALLIC SURFACE TREATMENTS

METAL FINISHING

VOLUME 47 • NUMBER 7 • JULY, 1949

Public Law 845

To the average citizen the complicated and ofttimes confusing legal activities of our elected lawmakers in the nation's Capitol seem as remote as the stars, and are all too often viewed with indifference—a notable exception being when the "boom is lowered" in the form of new taxes.

However, the recent "worst Congress in history", unquote, managed to include among its accomplishments the enactment of one bit of legislation that will make itself felt in the very near future by every firm in the nation engaged in plating activities. This legislation is commonly known as Public Law 845, but its official title is the Water Pollution Control Act.

Like the weather, much had been said about a Federal pollution law over the past half century, but nothing had been done about it until last year when P.L. 845 became the law of the land, although some states had passed rather toothless laws aimed at regulating and prosecuting stream and water pollution.

In its initial phases the new law aims at 1) The development of a program for abatement, 2) Research on causes, prevention and treatment, and 3) Construction of facilities to handle polluting wastes. An Advisory Board appointed to administer the law has already requested 2½ million dollars to initiate their program, with one million ear-marked for research and investigation of industrial waste problems. While the electroplating industry is only one of the many "culprits" that will come under the Board's scrutiny, the extreme toxicity of its wastes will surely cause it to be singled out for early and effective action. A solution to the problem which will be equally satisfactory to both the large and small plant is urgently needed.

Fortunately a study of the plating industry's own pollution problems is well under way, and a number of worthwhile methods are already being investigated. It would seem that the group presently engaged in this research work, having an intimate knowledge of the plating industry's waste problems, which are by no means simple, would be better qualified to carry on further work and arrive at an earlier solution, at least to one industry's problems, than any new agency which might be created by the Advisory Board. Perhaps the same foresight that prompted the initiation of the plating industry's waste disposal research tion, which is cheap enough considering the relative importance of the plating dollars that will undoubtedly be available to carry out the program of P.L. 845 be reserved for financing the continuation of the plating industry's already going program.

The funds estimated as being necessary to carry out this research on plating wastes amount to only several percent of the total industrial research appropriation, which is cheap enough considering the relative importance of the plating industry in the overall waste disposal program.

Such "dipping into the pork barrel" would be mutually beneficial to both the government's program and the plating industry's program—a rather unique experience.

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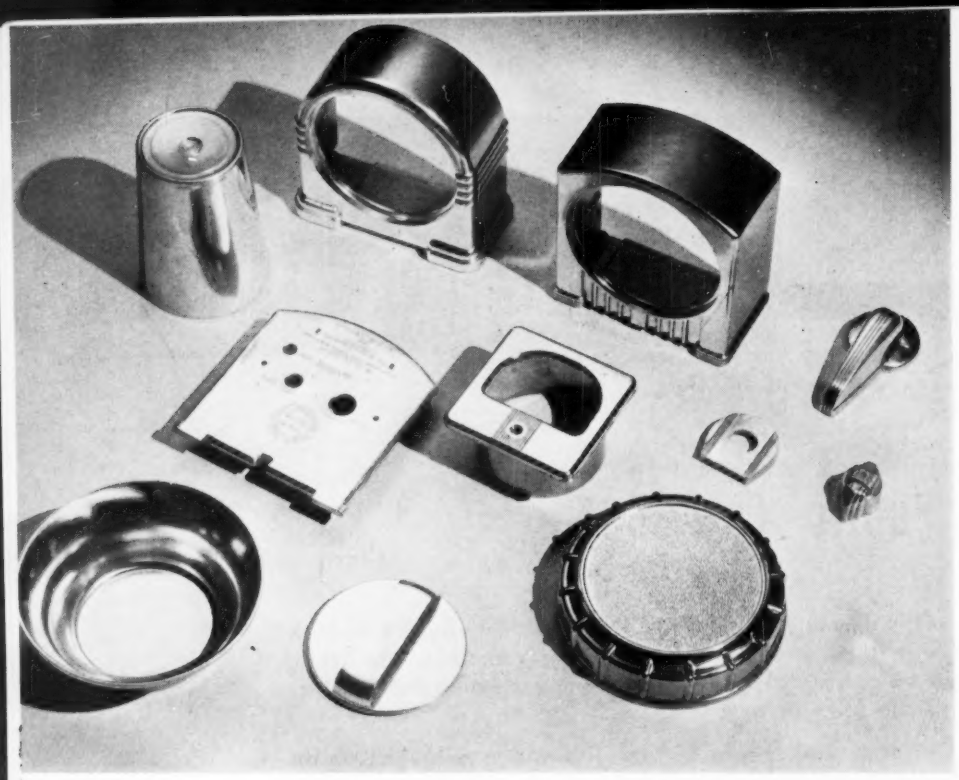

Deposition of Metallic Films by Vacuum Methods

By Samuel Wein, *New York, N. Y.*

THE use of evacuated vessels to form metallic films on non-metallic surfaces is the subject of considerable investigation by chemists, physicists and even electro-platers, primarily because of the thin films it is possible to produce, the wide variety of surfaces on which these films can be formed, and because of its adaptability to many industrial problems.

The vacuum method of metallizing is by no means new, and a review of some of the uses to which such methods have been put, and the methods used to accomplish that end is in order, so that the reader will have an idea as to what is involved in forming these metallic films.

Vacuum metallizing has certain advantages as compared with other methods:

1—Extremely thin films may be formed; so thin, in fact, that they may be used as optical filters and at the same time serve as electrical conductors, such as in the case of barrier photo-cells.

2—Metals can be applied to non-conductors without resorting to special chemical or physical treatments.

3—Materials can be coated which could not otherwise be coated if high temperatures or chemically destructive compounds were required, as in some other processes.

4—Alloys, and elements such as tellurium, silicon and selenium can be deposited on a surface in very thin layers.

5—One metal can be deposited on another that is far removed from it in the electrochemical series, whereas this is impossible by electroplating. For example, gold or platinum can be deposited directly on aluminum or magnesium.

The disadvantages in its use are:

1—The processes are comparatively slow and tedious.

2—The deposits are not made conveniently.

However, as vacuum techniques are adapted to the solution of industrial problems, it can be assumed that refinements in equipment will be made to overcome these disadvantages.

Applications

The vacuum methods for forming metallic films are manifold, and a complete resume is a difficult task; however, a short review of its applications is in order, proving that it is by no means a laboratory experiment or curiosity.

Mirrors

Aluminized glass mirrors when exposed to the atmosphere for more than 6 months show no tarnish. The permanence of the high reflectivity definitely exceeds that of silver protected by an evaporated quartz layer, according to *Cartwright and Strong.*[1] The aluminum is inert to corrosive agents because of the extremely thin layer of aluminum oxide which forms on the surface when removed from the evacuating chamber.

The aluminum adheres more tenaciously to glass than does silver, so that dust, etc. may be washed off safely with soap containing no caustic soda.

Aluminum mirrors have a greater uniformity than silver in reflectivity and transmission throughout the

visible wavelengths, and find wide application for interferometer plates for this reason.

Reflectors for incandescent lamps are formed on the inner walls of the glass bulb using either aluminum or silver as the reflecting medium, according to *Biggs*.[2]

Window glass has been coated with semi-transparent films so that those inside the building can see out, but those on the outside cannot see in. Advertising displays have been made by placing text and illustrations in a suitable box containing a source of light that flashes on and off periodically. When the light is on, the advertising copy can be seen, and when the light is off the display acts like a mirror, because of a coated glass plate within the box.

Optical Devices

Semi-transparent films of metals are used as optical filters having unique transmission characteristics dependent on the metal deposited, and are also used as optical filters which must simultaneously serve as electrical conductors, as in the case of a conducting medium for the barrier type of photo-cell.

Such filters may be formed of a single metal, or an alloy. Alloys are used where transmission of a specific color is required and where the required characteristics can not be obtained with a single metal. The following table shows the colors transmitted by certain metals.

Table I

Metal	Color Transmitted
Silver	Blue-violet
Chromium	Brown
Aluminum	Blue
Gold	Green
Copper	Green
Selenium	Orange

Any two or more of these metals applied to a glass surface as successive films will produce a transmission

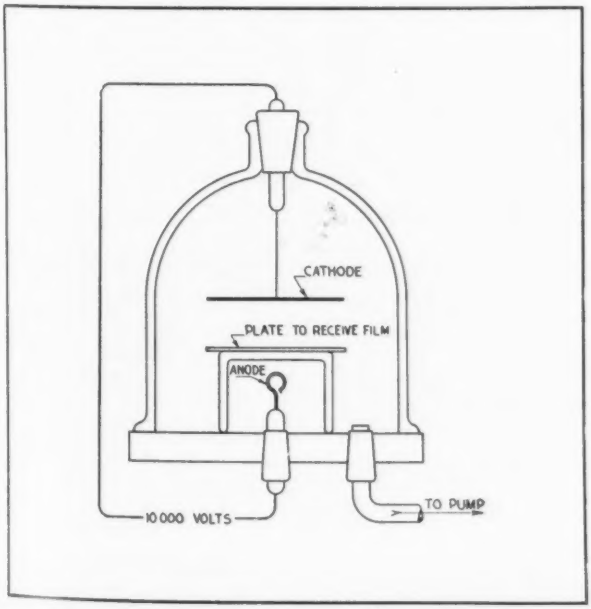

Figure 1. Experimental set-up for cathode sputtering.

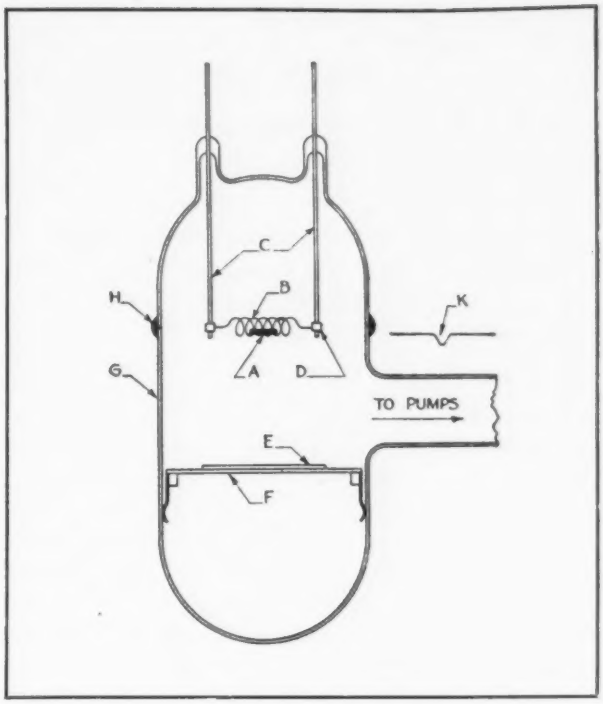

Figure 2. Arrangement for metal evaporation techniques.

equal to the product of the transmission of the component metals.

It is well known that a coating of a metallic fluoride on an optical lens will reduce or eliminate reflection at the glass-air interface, if the coating has the proper thickness. This is a most important application of coating technique, but as it does not involve metallic films we will not discuss it in this article.

In spectrophotometers, semi-transparent films which transmit all colors to an equal degree are employed to attentuate one source of light without affecting the color response. An alloy of chromium and platinum has such a characteristic. Another use of a semi-transparent film is in interferometers employed to examine minute contractions and expansions in industrial machines.

Beam splitting, as in binocular microscopes or in color cameras, is another use of thin metallic layers. For example, a film of an alloy of aluminum and copper will reflect red and blue light but will transmit green light, the aluminum reflecting the blue and the copper reflecting the red.

Electronic Devices

Vacuum deposited metal films are also used to increase the conductivity of fine quartz fibres used as suspensions in sensitive instruments such as quadrant and string galvanometers, electrometers and electrocardiographs, and shielding for high frequency oscillating circuits uses sputtered films on plastics and other insulating materials, according to *Benner*.[3]

Piezo crystals as used in radio oscillators are made of natural quartz or artificially grown Rochelle salt crystals. To it is made electrical contact thru vacuum deposited films, according to *Hulburt*[4] and *Kingsley*.[5] The *Bell Telephone Laboratories*[6] deposit a film of gold by evaporation on tartrate crystals grown from a

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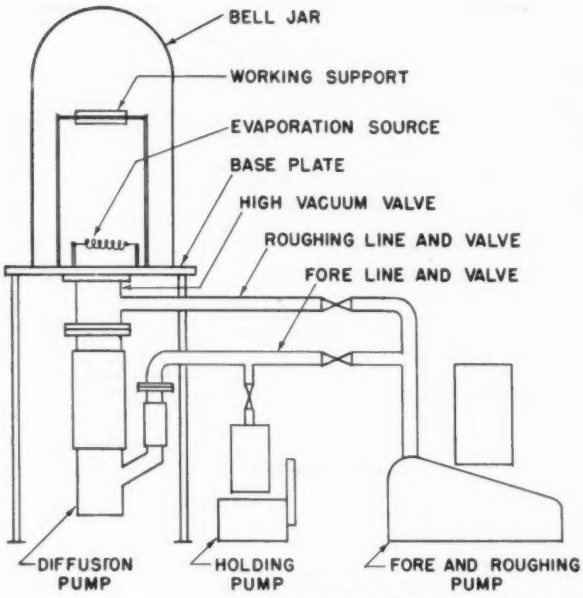


(Photo courtesy National Research Corp.)

Figure 3. Sketch showing the essential parts of a commercial metal evaporating apparatus.

solution of ethylenediamine tartrate. These crystals are used in preference to quartz in telephone co-axial circuits permitting a large number of phone conversations to take place over a single circuit.

Bolometers using a sputtered film of nickel of 200 Angstroms in thickness have been used for military purposes, according to *Billings*.[7]

Resistors used in electrical circuits of every kind use vacuum deposited electrical contacts, according to *Richtmyer*,[8] *Zworykin*[9] and *Holbruck*.[10]

Microphone diaphragms made of duralumin are coated with gold, according to the *Westinghouse Elect. & Mfg. Co.*

The front surface serving as the electrical contact to complete the circuit of a barrier type of photo-cell has a film of metal sputtered on the active surface. Since several hundred patents are involved, the complete listing of these cannot be given here.

Phonograph Records

Phonograph master records made originally in a wax like compound must of necessity be electroplated with a suitable hard metal and then backed up to a desired thickness for use as a "stamper." To accomplish this electroplating process, *Edison*[11] sputtered gold on the master (original) record, then backed the thin shell with copper by electroplating it. *Russell*[12] used palladium because it is harder than gold and is not affected by chemical action between the palladium surface and the resinous material with which it is in contact during the molding process.

Miscellaneous Uses

vonBoose and *Richter*[13] formed thin films of metals on all kinds of feathers for ladies' hats.

Materials such as vegetable and animal matter in the form of fabric or textile (cotton, wool, silk, paper, wood, linen, jute, hemp, leather, gelatin, mica, etc.) have been coated by *vonBoose*, *Pfanhauser*,[14] *Sommer*,[15] and others. Several manufacturers are producing thousands of yards of tinsel daily by coating metals on cellulose acetate, Cellophane and similar materials.

Glass, porcelain and earthenware for decorative and electrical purposes are coated with the various metals according to *Sommer*[15] and *Alexander*.[16]

Tin cans containing edibles have been coated so that contamination of the material by reaction between the contents and the tin is eliminated. Alloys of silver have been used for this purpose.

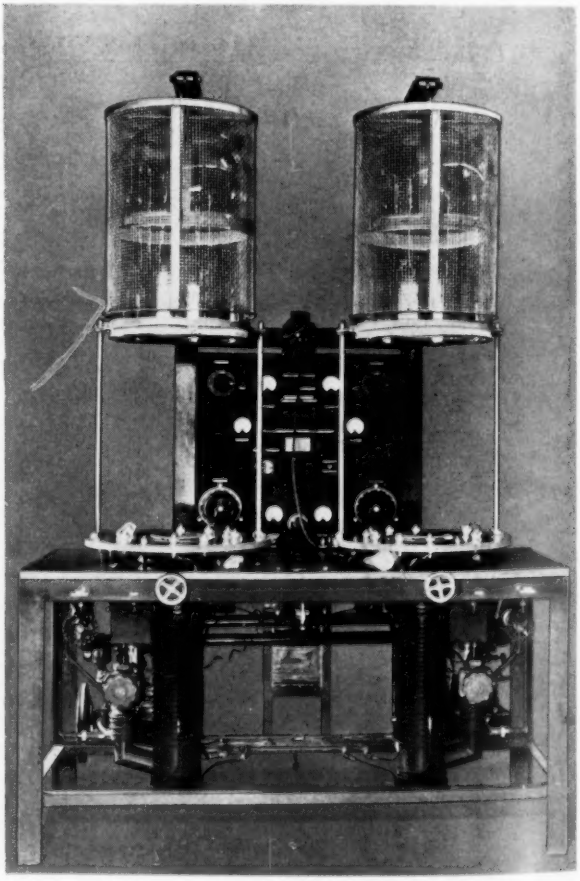
Methacrylate resins (Lucite or Plexiglas) are sputtered with a film of platinum to prevent static charges on their surfaces, according to *Goss*.[17]

Vacuum Methods

The success of the methods to be described depends largely on the degree of vacuum attained, and this in turn depends on the type of equipment used to obtain the vacuum. It is not the purpose of this paper to review the various types of vacuum equipment. An excellent paper dealing with the various types of vacuum systems is described by *Sullivan*,[18] to which the reader is referred.

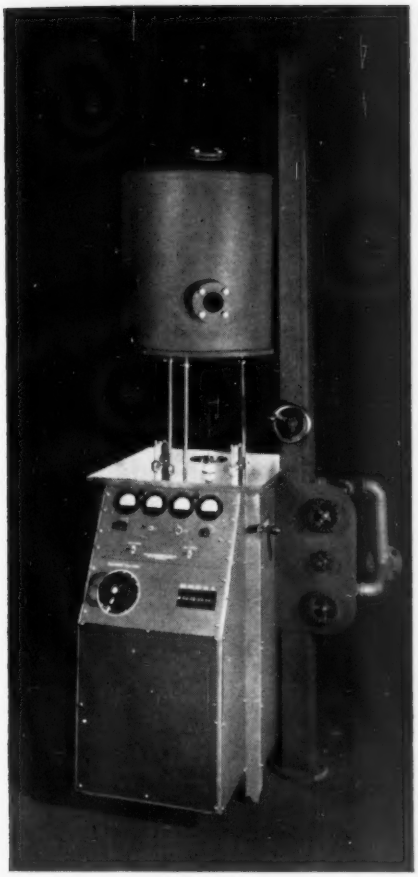
Cathode Bombardment

Of the processes herewith to be discussed, that which



(Photo courtesy Distillation Products, Inc.)

Figure 4. Double evaporation unit. One unit can be loaded while the other is being evacuated, saving production time. Note diffusion pumps underneath bench.



(Photo courtesy National Research Corp.)

Figure 5. Small commercial unit for metal evaporation. Note "peep" window in metal bell-jar.

is commonly termed as cathode bombardment, or "sputtering," is the older known. *Grove*[20] appears to be the first to have discovered that if a high voltage is applied between an anode and a cathode fixed in an evacuated chamber, the cathode will disintegrate and its metal will be found to be deposited upon the anode in an extremely thin and homogenous film. In Figure 1 is shown a typical set-up of such a method. A glass bell-jar sets on a metal plate. The bottom of the bell-jar is ground flat, and the space between it and the base plate is cemented to avoid leakage. An alternative method is to use a rubber gasket between the ground bell-jar bottom and the base plate. The pumps are now set into motion and the bell-jar is evacuated. Direct current is used at 2000 volts or more. In due time metal from the cathode will be deposited on the surface to be coated, which is placed on the plate. The space between the cathode and anode is usually between ½" and 6".

Since the early workers demonstrated that metallic particles could be "torn" off a cathode and deposited on an anode in an evacuated chamber, it is natural that with time a series of improvements in technique, equipment and design of equipment followed, and, for detailed treatises the reader is referred to the work of *deLodyguine*[19]; *Potter*[20]; *Russell*[12]; *Whiston, McIvor* and *Thein*[21]; *Knott*[22]; *Berghaus, Burkhardt* and *Reinecke*[23]; *Berghaus* and *Burkhardt*[24]; and *Meyer*.[25]

These improvements revolved around mechanical methods of cathode and anode placement, single and multiple elements, and in the use of inert gases in the evacuated chamber in order to increase the conductivity between the electrodes.

Distillation

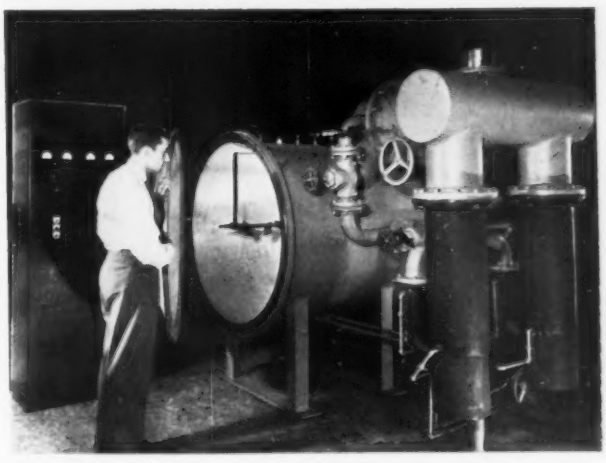
The present method, although not new in the literature, is being used to a greater extent commercially today than is the sputtering method, as the process is easier to operate and to reproduce; further, much lower potentials are used. The process depends directly on the distillation, or evaporation, of a metal from a hot filament in an evacuated chamber.

An early laboratory set-up of such a distillation method is shown in Figure 2. The metal to be distilled (A) is placed inside a tungsten coiled filament (B), which is clamped by strips of iron (D) to heavy tungsten wires (C). The material to be coated (E) is placed on a plate (F) supported in such a way that it can be raised or lowered to provide for various distances between A and E. If E is too close to A, the films will not be uniform, being thickest in the center. Also the heat from the filament might conceivably break the glass if this is too thick and too close to the filament. The progress of the evaporation can be seen by looking up toward the filament from the bottom of the tube; this is especially convenient when semi-transparent deposits are required. The envelope (G) is separable at point (H). Sealing can be accomplished with vacuum types of sealing wax.

With this set-up, according to *Garner* and *Case*,[27] films of iron, copper, silver, gold, lead, tin and aluminum have been made.

Filaments may be made of tungsten, molybdenum, platinum, etc., and in the form of a single wire or in multiple strands in the shape of a spring, helix, or cone. Figure 3 is a schematic of a commercial unit, and shows the various pumping units required to produce and hold the required high vacuum.

A listing of the metals and the temperatures at which they were distilled, according to *Cartwright*,[1] follows:



(Photo courtesy National Research Corp.)

Figure 6. Large commercial unit of the horizontal cylinder type. The equipment on the right is the high-vacuum diffusion pumps.

Metal	Evaporation Temperature Deg. C.	Metal	Evaporation Temperature Deg. C.
Mercury	47	Lead	727
Caesium	160	Tin	875
Rubidium	177	Chromium	917
Potassium	207	Silver	1046
Cadmium	268	Gold	1172
Sodium	292	Aluminum	1188
Zinc	350	Copper	1269
Magnesium	439	Iron	1421
Strontium	538	Nickel	1444
Lithium	548	Platinum	2059
Calcium	605	Molybdenum	2482
Barium	632	Carbon	2522
Bismuth	640	Tungsten	3232
Antimony	700		

Heating and Evaporating the Metal

Arc Heating

There are methods of arc heating, defined as follows:

A—In which metals in the form of pencils or rods are brought together, with a suitable voltage applied between them. Sometimes a voltage is applied between the cathode of the arc and the work in order to "pull" the metal ions over to the surface to be coated.

B—The metal is placed in an alundum boat, the metal particles serving as one electrode of a circuit, and a carbon pencil used to complete the circuit. The arc so formed will distill off the metal.

Resistance Heating

A resistance type of heating element is wound around the alundum boat containing the metal particles. This resistor heater serves as the source of heat.

(Photo courtesy Distillation Products, Inc.)

Figure 7. Complete industrial evaporation unit. Diffusion pumps under bell-jar, roughing and holding pumps in left foreground.

Induction Heating

High or low frequency currents can be used to heat metal in the form of a solid, powder or metallic salt to distill it, according to *Macksoud.*[28]

Gas Heating

A crucible containing the metal to be distilled can be heated by an external source of illuminating or other type of gas, according to *Menke.*[29]

Summary

This brief discussion of vacuum metallizing is intended only as an introduction to the principles involved, with some views of its present applications. This method of depositing metallic films by "dry" methods is destined to become of great importance industrially, and the progressive metal finisher owes it to himself to know how future developments in this field may affect the present established electroplating techniques. For those desiring to pursue the subject further, the following references should prove invaluable.

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Carbonate Removal from Cyanide Plating Solutions

By H. F. Ross, *Battelle Memorial Institute, Columbus, O.*

The accumulation of carbonates in cyanide plating baths has been a long-standing problem. Present methods for their removal by freezing out and precipitation with reagents have several disadvantages, and in this article the author reveals the results obtained by treating the baths with calcium carbide.—Ed.

IN THE operation of cyanide plating solutions, there is an inevitable accumulation of carbonate in the bath, due to the decomposition and oxidation of cyanide and the adsorption of carbon dioxide from the air. Ammonia and salts of formic acid are also present, as shown in the following reactions:

$$2\ NaOH + CO_2 \rightarrow Na_2CO_3 + H_2O$$

$$2\ NaCN + CO_2 + H_2O \rightarrow Na_2CO_3 + 2\ HCN$$

$$2\ NaCN + CO_2 + 5\ H_2O \rightarrow Na_2CO_3 + 2\ NH_3 + 2\ HCOOH$$

$$2\ NaCN + 2\ NaOH + CO_2 + 3\ H_2O \rightarrow Na_2CO_3 + 2\ NH_3 + 2\ HCOONa$$

$$2\ NaCN + 2\ NaOH + 2\ H_2O + O_2 \rightarrow 2Na_2CO_3 + 2\ NH_3$$

$$2\ NaCN + 3\ H_2O + O_2 \rightarrow Na_2CO_3 + 2\ NH_3 + CO_2$$

The particular reactions that occur depend upon the temperature and relative concentration of the bath constituents. Hot solutions invariably accumulate carbonate more rapidly than cold solutions. Agitation accelerates the adsorption of carbon dioxide and brings oxygen into contact with the cyanide. Agitation by compressed air saturates the cyanide solution with oxygen. Plating barrels expose a considerable surface of solution to the atmosphere, thus increasing the formation of carbonate. It is reported[1] that sodium carbonate formed at a rate of 0.02 ounces per gallon per square foot of solution surface per twenty-four hours in a high-efficiency cyanide copper bath.

An excessive concentration of carbonate has a deleterious effect in some cyanide plating solutions, especially cadmium, zinc, silver, and copper, by affecting the quality of the cathode deposit (porous or spongy), and by lowering the anode and cathode current efficiencies. For example, sodium carbonate in amounts above 5 to 6 ounces per gallon lowers the current-density range for bright deposits in the average cyanide cadmium solution. These adverse conditions caused by carbonates can only be eliminated by removing or reducing the carbonate content below a detrimental amount. In cyanide-silver baths, it is often desirable to maintain a definite amount of carbonate. A cyanide-copper plating solution can be so formulated that the concentration of sodium carbonate reaches an equilibrium at about 18 to 19 ounces per gallon, which concentration does not appear to be harmful to the bath, so no control of the carbonate content is needed.[2]

For solutions high in carbonate, the temperature is sometimes raised to obtain better results, but this hastens the rate of solution decomposition and consequent carbonate formation, thus making the bath more unsatisfactory. Likewise, by increasing the current density, the solution becomes more heated and the formation of carbonate is thus promoted.

The Author

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Freezing Out Carbonates

The "freezing-out" method for removing carbonates depends upon cooling the plating solution to a temperature of 32°F. or lower, when most of the sodium carbonate crystallizes out.[3, 4] This process introduces no impurities and the metal-to-cyanide ratio remains unchanged, but it is capable of removing only the sodium carbonate in excess of 8.5 to 10 ounces per gallon for the commonly used plating baths. If the total salt concentration in the bath is high enough, the carbonate can be reduced to levels below 8.5 ounces per gallon. There is danger also of "freezing-out" metal cyanides if the operation is not conducted carefully.[5] The procedure is expensive in warm weather and usually necessitates a temporary shut-down of the plating bath.

Precipitating Carbonates With Calcium

The use of a calcium compound is considered a more desirable method from the viewpoint of cost, availability, and low solubility of calcium carbonate. The common calcium compounds used are: calcium hydroxide (slaked-lime), calcium cyanide, calcium chloride, calcium sulfate, and calcium carbide. The use of calcium hydroxide is objectionable because of its low solubility and its tendency to become coated with calcium carbonate, which causes incomplete reaction and thus produces indefinite results. Calcium cyanide presents a health hazard, due to its liberation of free hydrocyanic-acid fumes upon exposure to moist air. Calcium chloride forms sodium chloride, which would accelerate the corrosion of the iron tank. The use of calcium sulfate is highly recommended.[6, 7, 8] A pure and finely ground form of calcium sulfate is commercially available as a "carbonate remover." Calcium sulfate is capable of reducing the carbonate content to a fraction of an ounce per gallon, and it can be kept in excess at all times, allowing continuous removal of carbonate as soon as it is formed. The amount of calcium sulfate required is 1.6 times the weight of sodium carbonate to be removed. The resulting sodium sulfate concentration does not appear to be harmful. In one particular cyanide-zinc plating bath, 10 ounces per gallon of sodium sulfate produced a slight decrease in the cathode current efficiency and a slight increase in the throwing power.[9]

Carbide Precipitation Method

Calcium carbide also is a suitable "carbonate remover" because of its low cost and high chemical activity.[10] The amount of calcium carbide required is 0.6 times the weight of sodium carbonate to be removed. Thus, 3 parts of calcium carbide will remove the same amount of carbonate as will 8 parts of calcium sulfate. The calcium carbide reacts completely with water to produce calcium hydroxide and acetylene; the calcium hydroxide disperses throughout the bath, and the acetylene gas escapes safely through the exhaust system:

$$CaC_2 + 2\ H_2O \rightarrow Ca(OH)_2 + C_2H_2\uparrow$$

The finely divided and dispersed calcium hydroxide reacts with sodium carbonate to form sodium hydroxide and to precipitate out calcium carbonate:

$$Ca(OH)_2 + Na_2CO_3 \rightarrow 2\ NaOH + CaCO_3$$

Since 0.8 ounce per gallon of calcium carbide yields 1.0 ounce per gallon of sodium hydroxide, the calcium carbide should be used in small amounts sufficient to yield the desired free caustic content. Also, the periodic addition of small amounts of calcium carbide prevents the liberation of a dangerous amount of acetylene. The carbonate removal can be performed very conveniently by treating a portion of the plating solution in an auxiliary tank and then returning the purified solution to the original tank. By following this procedure, the steam coils or any obstructions in the plating tank will not interfere with the removal of the precipitate. The isolated calcium carbonate may entrap valuable plating solution which can be recovered by leaching the precipitate in clean water, and using the resulting liquid for make-up solution.

If the calcium carbide is pure, the metal and cyanide content will remain unchanged. Technical calcium carbide is suitable to use since its inert impurities of free carbon and sulfides will settle to the bottom of the tank.

In a period of time, if so desired, all of the sodium carbonate can be removed as precipitated calcium carbonate. In a newly prepared plating solution, calcium carbide could be used to maintain the free caustic content, and any excess of calcium hydroxide would remove the carbonate as soon as it formed. Also by using calcium carbide periodically, the carbonate content can be held at any desired concentration.

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Electrodeposition of Copper-Lead Alloys from Fluoborate Solutions

By C. B. F. Young, Ph. D., and Clifford Struyk, M.S., *Polytechnic Inst. of Brooklyn*

While the authors report negative results in this investigation, it is felt that the data developed will be of interest to others in the field of alloy deposition, and may possibly stimulate further research on this important problem.—Ed.

BEARING materials, which at one time were simple alloys of lead and tin, now include a large number of varied and complex alloys. This change has been brought about by the continual increase in the speed and power developed by internal combustion engines, with the attendant heavier loads on bearing surfaces. The improvements in bearing materials follow along the lines of adding alloying elements to improve desirable properties, better methods of manufacture to improve quality, or the development of new bearing materials. The characteristics required of a bearing material have been summed up in a paper by *Gillett, Russell and Dayton.*[1] These include:

Fatigue resistance, embeddability and conformability, seizure resistance, corrosion resistance and bondability, if a lined bearing.

Since it is impossible for a single bearing material to rate high on all the desirable properties, the choice of a single bearing material on any application represents a compromise. Lead is an excellent bearing material in that it meets many of these requirements. However, it has low strength and poor corrosion resistance to corrosive products formed by decomposition of lubricating oils. Alloying tin or indium with the lead overcomes the drawback of poor corrosion resistance.[4] In order to obtain strength required for bearings with high loads and still retain the valuable characteristics of lead, it has been alloyed with copper and cast on to steel backs. These bearings of cast copper-lead have been used extensively.[7]

The application of the cast copper-lead bearing is limited because of difficulties encountered with lead segregation during the casting process. The lead, instead of forming a uniform minute dispersion throughout the copper, collects in large dendrites. These areas do not have the strength required for heavy duty loading. In addition, areas of poor bond arising during casting may result in failure of these bearings. When the cast copper-lead bearings are used for heavy duty applications they must conform to strict X-ray inspection standards to eliminate those bearings with large dendritic and poor bond areas. The number of cast copper-lead bearings that must be rejected for some

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applications is so high that it has seriously limited the use of this type of bearing material.

Another method used to utilize the excellent properties of the copper-lead system without imposing the limitations of the casting method of preparation is to use a grid-type bearing. In this the surface of a copper bearing is gridded by knurling or machining depressions into it. Lead is then applied to the surface and may be then machined back so the final surface contains small sections of lead surrounded and supported by the copper. The copper may be either rolled into shape or applied by electrodeposition. The bearing described, probably because of the higher cost of the close machining tolorances required, has not attained the wide use of the smooth, sleeve-type bearings.

Because of the limitations noted above, the cast copper-lead bearings have been replaced in heavy duty applications, such as in aircraft engines, to a very great extent with plated silver bearings. These are generally used with a thin overlay of plated lead-tin alloy to improve the seizure resistance and embeddability. Because of the higher material cost of the plated silver bearing it is reasonable to assume that if the copper-lead bearing could be improved by removing the limitations imposed by the casting process, this bearing material would again be used in many applications where it has been replaced with silver bearings. In addition, the embeddability of copper-lead is superior to that of silver, an important factor where bearings must be operated under adverse dirt conditions. Electrodeposition of the copper-lead alloy results in an improved bearing material.[5] The solution used for depositing the alloy, as disclosed by *Bollenrath*, was an alkaline tartrate—acetate—citrate bath. Another reference[6] disclosed the use of a fluoborate bath for depositing copper-lead alloys. Because the fluoborate baths have been used successfully for the rapid deposition of heavy deposits, a definite advantage for commercial utilization of the process, it was decided to explore the possibilities of this system to produce copper-lead alloy deposits. For commercial use these solutions must be capable of producing deposits containing 6 to 20% lead in thicknesses of 0.008 to 0.090 inches.

Experimental Procedure

Two hundred ml. of the solution to be tested were placed in a 250 ml. beaker. A cylindrical copper anode lined the inner circumference of the beaker. A stainless steel cylinder 0.90" in diameter and 1.1 inches long was used as the cathode. An insulated steel rod screwed into this cathode was used to support it in the solution. A constant speed motor rotated the cathode in those tests where movement was required. The cathodes were weighed, plated and reweighed to give the total weight of plate. The deposits were stripped in dilute nitric acid and analyzed for copper by the volumetric fluoride-thiosulfate method.[3] Lead was determined by difference.

Results

The data collected is summarized in the following tables. In all cases the baths were made up from plating grade fluoborate chemicals, plus the various indicated additions.

Table I—Effect of Metal Ratio on Deposits

Solution					Deposit	
Copper g/l	Lead g/l	Ratio Cu/Pb	Temp. °F	Cathode Rotation RPM	Appearance	% Copper
95	5	19	80	0	smooth matte	99+
90	10	9	80	0	smooth matte	99+
80	20	4	80	0	smooth matte	99+
60	40	1.5	80	0	smooth matte	99+
50	50	1	80	0	smooth matte	99+
40	60	0.67	80	0	matte	99+
20	80	0.25	80	0	loose dark	
10	90	0.11	80	0	rough dark	
95	5	19	80	100	smooth matte	99+
90	10	9	80	100	smooth matte	99+
80	20	4	80	100	smooth matte	99+
60	40	1.5	80	100	smooth matte	99+
50	50	1	80	100	smooth matte	99+
40	60	0.67	80	100	matte	99+
20	80	0.25	80	100	sl. burnt	
10	90	0.11	80	100	non adherent	

Current density 50 amp./sq. ft.
Solution pH 0.3

Table II—Effect of Cathode Rotation on Deposits

Solution					Deposit	
Copper g/l	Lead g/l	Ratio Cu/Pb	Temp. °F	Cathode Rotation RPM	Appearance	% Copper
80	20	4	80	0	smooth matte	99+
80	20	4	80	100	smooth matte	99+
80	20	4	80	500	matte	99+
80	20	4	120	0	matte	99+

Table III—Effect of Cathode Current Density on Deposits

Solution					Deposit	
Copper g/l	Lead g/l	Ratio Cu/Pb	Temp. °F	C. D. asf.	Appearance	% Copper
50	50	1	80	10	matte	99+
50	50	1	80	25	matte	99+
50	50	1	80	50	smooth matte	99+

Table IV—Effect of Lead Content of Solution on Deposits

Solution				Deposit	
Copper g/l	Lead g/l	Ratio Cu/Pb	Temp. °F.	Appearance	% Copper
80	40	2	80	matte	99+
80	60	1.33	80	matte	99+
80	80	1	80	matte	99+
80	160	0.5	80	matte	99+
80	240	0.33	80	matte	99+

Table V—Effect of Solution Acidity on Deposits

Solution					Deposit	
Copper g/l	Lead g/l	Ratio Cu/Pb	Temp. °F.	pH	Appearance	% Copper
50	50	1	80	1.4	matte	99+
50	50	1	80	0.3	matte	99+
50	50	1	80	0.1	matte	99+

(*Concluded on page* 53)

Finishing Surgical and Hospital Equipment At American Sterilizer Co.

By Walter Rudolph, *Erie, Pa.*

LAST year *American Sterilizer Co., Erie, Pa.*, moved into a two-floor 100′ x 91′ plant addition, the second floor of which is about equally divided between sub- and final assembly operations, and the plating and polishing department. The latter was moved from the old plant location and expanded, because output of sterilizing equipment of all kinds, as well as surgical and general medical supplies, has measurably increased since the war. About twenty thousand dollars were spent in the re-location and re-equipping of the modern plating-polishing layout, with perhaps the major differences in procedure and layout falling to the cleaning and plating setups.

Let's consider the metal finishing job which this manufacturing plant must handle. Practically everything, from small screws to water tanks of 50-gallon capacity, going into sterilizer and other hospital equipment, is plated and polished at this plant. As to the volume of work handled—some 100 dressing sterilizers are produced monthly, about 150 utensil sterilizers, 90-100 operating tables, 40 major operating lights, 50 emergency operating lights, about 100 invalid walkers, and uncounted spare parts for these items stream monthly from the shipping department.

Figure 1—Gleaming, quality metal finishing is necessary for hospital equipment, such as viewed by *John J. Stroh*, polish-plating supervisor at American Sterilizer Co.

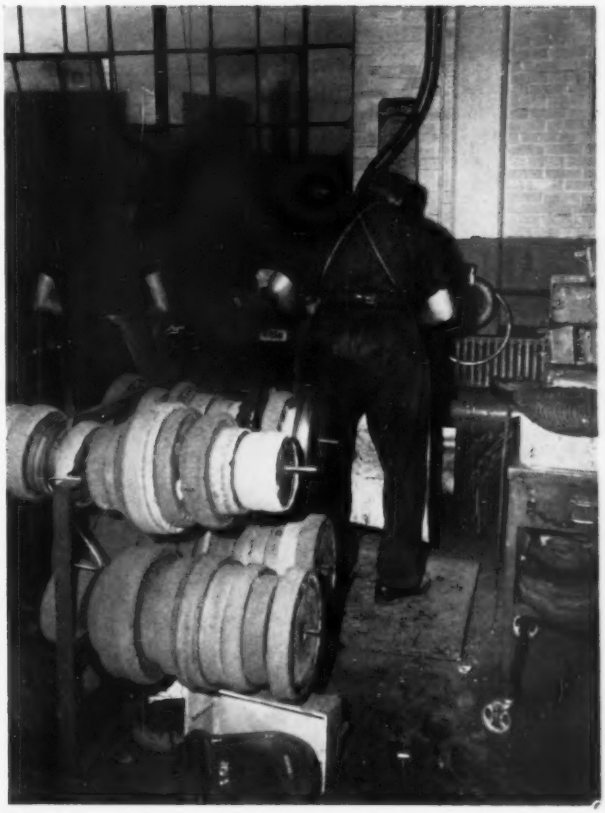

Figure 2—Polishing is carried out with headed wheels on these variable speed lathes.

The finishing problem, then, is one of extreme diversity as to size and shape, as well as types or kinds of finish. Formerly the department was becoming more and more inefficient as the volume of parts flowing through finishing operations increased, and materials

Figure 3—A "ground" view shows movable catwalk sections which put workers at convenient height to finishing tanks.

handling and inadequate facilities tended to bog down the work.

Following are some of the essential changes made:

1—The change was made from an outmoded cold Watts nickel solution process to a modern bright nickel including the installation of one 1500-gallon and an 800-gallon tank.

2—Chrome plating tanks were enlarged, comprising new 200 and 800 gallon tanks.

3—A Rochelle copper bath was installed, in a 500-gallon tank.

4—Larger cleaning tanks were installed, a 600 gallon and a 200 gallon tank for steel and brass parts.

5—A monorail system was installed over all finishing tanks to expedite the handling of racked parts.

6—A catwalk was built throughout the finishing area, 20" above the floor proper; glass bricks were placed under finishing tanks so that every tank levels off 32" above the catwalk, thus all work is carried on at a convenient, never-changing height.

7—In the new set up, a very old motor-generator system has been replaced with three 1500 amp., 8-volt selenium rectifiers. Advantages in choosing rectifiers were reported to be that less floor space was required for such installations, and that they could be placed closer to individual plating cycles. The higher initial cost of a new motor-generator was also a factor in their choice.

8—With the bright nickel process, two color-buffing operators could be dispensed with, while the volume of work under the new setup has increased about 30%.

9—A new barrel nickel plater has been added to speed up the handling and volume on smaller parts; a portable unit was formerly used.

10—The polishing department itself has a better location in the new addition, with machinery lined up on the east side of the building to obtain direct daylight from extensive windows, while working conditions are improved with a wet-system dust collector.

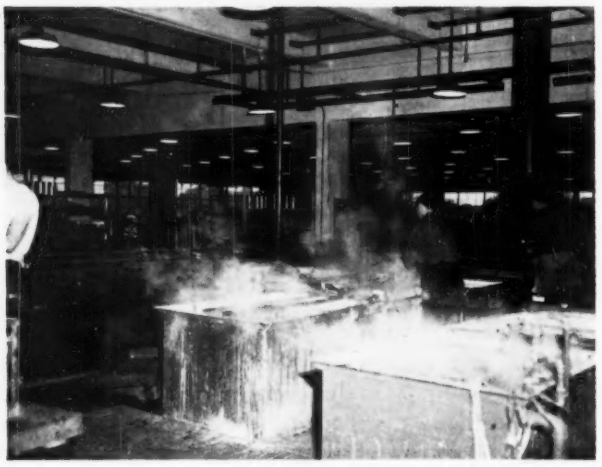

Figure 4—Looking across one section of the relocated and expanded finishing department at American Sterilizer. Cleaning tanks in foreground.

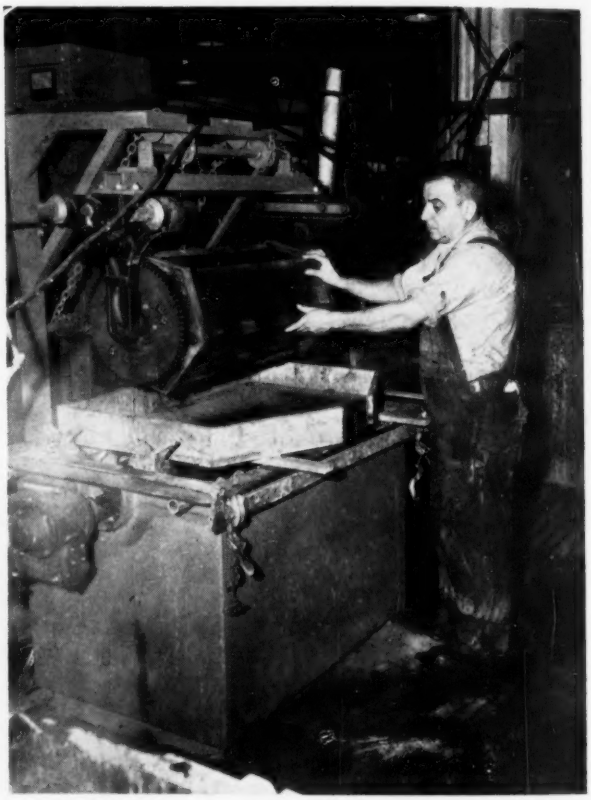

Figure 5—This new barrel nickel plater replaced a portable unit, which was inadequate for increased production.

Plating Operations

Since our main interest is in the plating operations, we will note some details of the procedures. Beauty and quality, it goes almost without saying, are essential in finishes for hospital equipment, and American Sterilizer products are mainly copper-nickel-chromium plated.

The individual plating operations go somewhat as follows: for copper, parts get a pre-soak alkaline cleaning, electro-cleaning, water rinse, acid dip (dilute sulphuric), water rinse, copper plating and finally water rinse. After buffing, the bright nickel cycle follows the same cleaning cycle, then comes to the nickel bath, cold water rinse and finally a hot water rinse. For chromium plating, parts are activated in alkali cleaner, water rinsed, sulphuric dipped, water rinsed, chromium

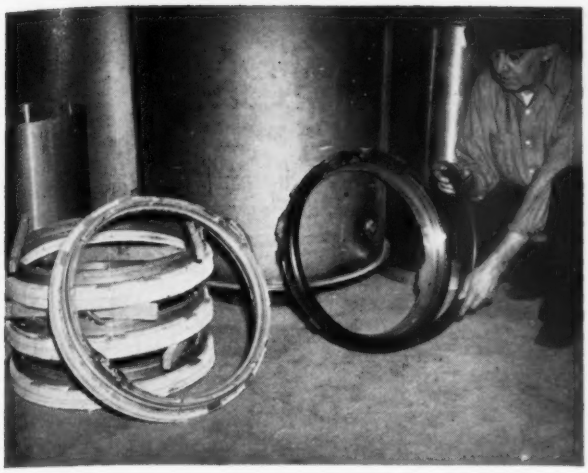

Figure 6—End rings, which are cast in brass, machined and plated, are covered with protective hose sections, one of which is being applied here. Sterilizer shells in background.

plated, rinsed in a reclaiming tank, and then cold and hot water rinsed.

On brass parts, a minimum of .0006" nickel is held; steel parts get .0012" nickel, while chromium is held to the more-or-less standard of .00001" thickness.

In the nickel process, continuous filtration is used. Temperature is held at 150 degrees F. (all heating is by plant steam lines); and all tanks are thermostatically controlled. For better throwing power in chromium plating, a 33 oz./gal. chrome bath is used, which is reported to be less expensive because of less drag-out, while at the same time doing a good job.

American Sterilizer designs and makes all its own racks for plating as they believe that this is the most economical approach to the problem of plating small lots of so many intricately shaped parts, such as operating table headrests. On the latter, for instance, special anodes must be arranged to get the maximum throwing power in the chromium plating cycle, auxiliary anodes being placed at the depth of the headrest recess.

Variable speed polishing machines are principally used. In polishing brass, the most commonly used base metal, 80 and 120 grit wheels are used in rough work, while 180 to 220 grease cut-down and coloring steps complete the polishing.

John J. Stroh, polish-plating supervisor at American Sterilizer, commented on the efficiency possible with such variable speed machines, running from 1500 to 3000 r.p.m., enabling the operator to keep the surface speed constant in relation to the wear on the buffing wheel.

Concrete flooring beneath the finishing tanks is covered with an acid-resisting asphalt, and the floor surface slopes to a conveniently located drain to ease maintenance work.

This firm is completely satisfied that the expenditure made to renovate and enlarge their finishing facilities has been amply justified, and that the new installations are rapidly paying for themselves in increased production, higher quality, and pleasanter working conditions for their finishing department employees.

ELECTRODEPOSITION OF COPPER-LEAD ALLOYS

(*Concluded from page 50*)

Table VI—Effect of Addition Agents on Deposits

Solution			Deposit	
Copper g/l	Lead g/l	Additive	Appearance	% Copper
80	20	gelatin 0.2 g/l	cracked	92
*80	20	gelatin 0.2 g/l	cracked	96
50	50	sodium fluoborate 100 g/l	matte	99+
50	50	ammonium fluoborate 100 g/l	matte	99+
50	50	resorcinal 10 g/l	matte	99+
80	160	resorcinal 10 g/l	matte	99+
50	50	resorcinal 10 g/l	matte	99+
50	50	molasses 1.4 ml./l	matte	99+
80	160	molasses 1.4 ml./l	matte	99+
50	50	processed protein 1 g/l	cracked	93
80	160	processed protein 1 g/l	cracked	88
50	50	beta naphthol 1 g/l	matte	99+
50	50	urea 1 g/l	matte	99+
50	50	proprietary	matte	99+
80	160	processed protein 1 g/l + resorcinal 10 g/l	cracked	90
80	160	processed protein 1 g/l + beta naphthol 1 g/l	cracked	90
80	160	thio urea 0.1 g/l	cracked	92
80	160	Daccolyte 1 g/l	some cracks	95
80	160	goulac 1 g/l	some cracks	91

Cathode current density 50 amps/sq. ft.
Solution temperature 80° F.
* Cathode rotated at 100 rpm for this test.

Discussion

The deposits obtained under the conditions defined in Tables I-V contained better than 99% copper. From this it appeared that, under normal conditions of solution metal concentration, acidity, temperature, agitation, and current density, lead could not be co-deposited from fluoborate solutions with copper. A number of addition agents which are commonly used in acid copper baths or lead plating baths were then investigated. The results are tabulated in Table VI. Some of these agents, namely gelatin, processed protein, thiourea, goulac and Daccolyte did allow the co-deposition of lead with copper. However, the deposits in all cases were badly cracked and would not be considered acceptable for commercial work. It would appear that the successful plating of copper-lead alloys from fluoborates depends on the use of an addition agent that will cause the lead to be deposited with the copper but which would not have the detrimental effects exhibited by the addition agents tested. Time did not permit a full investigation to determine if such an agent exists.

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Electrodepositors Technical Society Annual Conference

Abstracts of Technical Papers

THE Electrodepositors' Technical Society held their Annual Conference in April this year at Buxton, Derbyshire, England (which is near Sheffield), in honor of the comparatively newly formed Sheffield Section of the Society. It was attended by some 250 delegates, including a number from the European Continent, and proved to be an unqualified success.

Four papers of considerable interest were presented and discussed, as follows:

"Some Aspects of De-burring and Polishing in Barrels," by H. Weiss.

"Barrel Plating without Tears," by A. W. Wallbank.

"Causes of Blistering of Electrodeposits on Zinc Alloy Die Castings," by S. Wernick, H. H. Symonds and H. C. Castell.

"Preparation of Surfaces for Electrodeposition and the Influence of such Surfaces on the Characteristics of the Deposit," by A. T. Steer.

We give below a brief version of each of these contributions for the benefit of our readers.

SOME ASPECTS OF DE-BURRING AND POLISHING IN BARRELS

The paper attempts some explanation of the process with a view to its engineering development. The actual motion of the articles is considered at some length and the way in which they become burnished or polished. From these conclusions the way in which the load should be made up is worked out and the best size of barrels and speed of motion is considered. The type of medium used for abrasion is discussed and artificially compounded stones are described containing fine abrasive in a softer matrix.

Effects of Barrelling on Different Surfaces of Components

In many cases the choice of a finer file or finer emery wheel before barrelling would prepare the components so much better that one or two further wheel processes will be unnecessary after the barrel operation. A partial removal of heavy flash or burr on the abrasive wheel before barrelling, involving only a fraction of the time used otherwsie, may be indicated in other cases. In short, barrelling is often unjustly condemned if it cannot do the whole job, yet barrelling costs are usually so low that the exclusion of only one manual process will often pay in one year for capital outlay and running expenses.

Description of Movements in the Barrel

Some writers on the subject believe in a more or less continuous rolling or churning motion of the mass which they consider more important than the sliding movement of the top layer. Others describe experiments with a rotating glass jar, and state that the mass is almost stationary, while the edge of the load on the upgrade side of the barrel tumbles over and slides diagonally across. They say that this is the only active motion-producing effect. The author believes this to be a fallacy for the following reasons: even in a barrel with glass walls one cannot see what goes on inside the mass. More important, while the edging-over and sliding across is plainly visible, small movements which must be connected with the described slide are not evident. The parts travel after the slide through the bottom half of the barrel until they reach the top of the edge before the next slide. It would require a transparent load and a photographic picture projected in very slow motion to follow the travels of the single parts and their relative motions. The author believes that there are four distinct movements in a cylindrical barrel.

(1) The relative motion of the seemingly stationary mass against the bottom wall of the barrel.

(2) While the adhesion to the barrel wall causes the mass to climb up on the upgrade, the force of gravity works in the opposite direction. Thus, on the upgrade, a sagging or settling of the parts takes place continuously within the mass. The nature and quantity of this motion depend on the relative specific weights of components and media, and on their differences in size and shape. Heavy components have more force for settling and press on lighter and smaller media to give way. Smaller media find empty spaces to settle in every direction. The same happens at the moment when the top edge breaks over, when only a relatively small number of parts or media which are really on top, take the long slide, whereas all others settle down into the mass. These movements are short, very numerous, and can be described as small rubbing actions between parts and media.

(3) The slide across the diagonal of the barrel. This is the longest and most obvious motion.

(4) At the end of the slide, parts and media both disappear into the mass and are "buried" by the following parts and media. Again a settling action happens with small relative movements of rubbing and churning.

It can be assumed that the rubbing against the

barrel wall (1) and possibly the slide (3) help towards de-burring and rounding off. But these two movements can have no appreciable effect on flat areas, and almost none on curved or concave areas and recessed surfaces of a component. Moreover, experiments with a glass jar of 5″ diameter have shown that every component turns up on top only after three or four revolutions of the jar. (The glass jar was filled to exactly half its capacity.) The result was the same with a number of different materials. It could also be observed that the component appeared on top after it had been seen on or near the bottom wall of the jar. It can be assumed that in a barrel with larger diameter, for instance, 15″, a part would turn up for the slide much less frequently, perhaps once in nine to twelve revolutions. If the capacity of the barrel has a casual relation to the intervals, then a part might need 27 to 36 revolutions before taking the slide again. Anyhow, the inference can be drawn that movements (1) and (3) play even a lesser part in the surface effects than described.

We do not know how far the movements (2) and (4) extend to the centre of the mass. It must be assumed that these two movements also are numerically decreased in large diameter barrels against smaller ones. They may be increased in intensity by other forces, one of which is pressure due to increased weight.

Proper Loading and Ratio Between Goods and Media

One of the purposes of the media is to keep the components separate from each other, and the ratio between workpieces and media should always be much in favor of the latter. One part of goods to three parts of media is about the maximum for the safe barrelling of small parts. This ratio should increase up to one to ten for medium-sized parts, and up to twenty-five parts of media or higher for heavy parts. The ratio should be determined by volume; if the workpieces are of an awkward shape the cubic measure of their overall dimensions should be taken, and not their real volume. The total load should fill at least 60 per cent of the barrel volume. If the barrel is loaded to exactly half, the slide of the workpieces across the diagonal will be the longest, and any action connected with the slide more effective, but at the end of the journey the piece will hit hard against the barrel wall, and this impact will leave a mark. The heavier the single workpiece the more it will increase its velocity in this slide, and the harder it will hit. To prevent this, barrel loads with heavy pieces should sometimes be up to 70 or 80 per cent.

BARREL PLATING WITHOUT TEARS

The author of this paper states that the present system of barrel plating cannot give the thickness of coating that is required for good corrosion resistance or even to satisfy the existing specifications. This chiefly arises through a complete lack of appreciation of the very large surface area of small articles in bulk. By means of calculations and graphs for screws, as an example, the author shows that either the current used or the time of plating must be materially increased to obtain adequate deposits. Passing on to the usual design of plant, he indicates its deficiencies, particularly as regards anode contacts and conductors, also the small exposed area of work at any time. By means of numerous illustrations he indicates how many of the difficulties are overcome. After describing the possibilities of automatic and continuous barrel plating plant, the author describes improved layouts and especially automatic timing and current supply equipment.

The available volume of solution is a neglected feature which often depends upon the lay-out rather than the barrel design. When tank plating, the ratio of solution volume to cathode area is about 20 gallons per sq. ft. In a horizontal barrel, 2 gallons per sq. ft. would be average, while inclined barrels can be as low as ¼ gallon per sq. ft. Every gallon of solution in an inclined barrel is therefore transferring metal from anode to cathode at a far higher rate than in a tank, and there is a corresponding tendency for the solution composition to change rapidly. If each barrel has a separate solution it is virtually impossible to maintain solutions at the optimum composition. The better way is to link a whole battery of barrels to a sump and storage tank system of adequate volume. This helps to cancel out changes in individual barrels, and lessens the analyses required. Furthermore, it becomes possible to incorporate filtration and temperature control in the system.

Consistent Control

The aim of barrel plating is, or should be, to deposit an adequate thickness with certainty and consistency. This depends directly on time, on total current, and on the surface area of the load. The first of these variables is often left to the plater, the second usually, and the third invariably. A barrel plater is normally on piece work, and therefore has every incentive to plate as much material for as short a time per load as he can. The only way to attain any degree of consistency is to turn these variables into constants outside the control of the operator.

The greatest variable is surface area of load. A standard barrel load surface is the pre-requisite of consistency in plating. Once the standard barrel load has been established, current control is simplified. If a battery of barrels is using a common solution and the load area is constant per barrel, it should be sufficient to feed that battery from a bank of rectifiers at a pre-set voltage and thereby take current control off the plater altogether. The only electrical equipment on the barrel control panel will then be a switch for the barrel motor and a good moving coil ammeter.

The time variable is also easy to standardize once area and current are fixed.

CAUSES OF BLISTERING OF ELECTRODEPOSITS ON ZINC ALLOY DIE CASTINGS

In this paper, the authors deal with one of the most common difficulties encountered in plating zinc

base die castings, and propound new theories based on interesting research into the problem.

Zinc base die castings as widely used for motor car accessories have long been known to fail through blisters on the plated coat. Dr. Wernick and his collaborators show that these blisters may be divided into two kinds—of which the first are called "service" blisters. These do not arise until some time after plating and are usually due to defects such as pores in the plating and corrosion, proceeding through this to the reactive zinc below. The other kind are "process" blisters, which occur immediately after completion of plating and have hitherto been the source of considerable worry and difficulty to the plater. As a result of examination of some hundreds of actual blisters by microscopical and other means, the authors show and illustrate that these "process" blisters are related to the production of locally corroded sites on areas on the casting surface, which adversely affects the deposition of sound plating. The surface corrosion of the casting is intergranular in character, providing conditions which can result in the trapping of chemical solutions, electrolyte, etc. It seems probable that interaction between the latter and the zinc, or between entrapped solutions and the base metal gives rise to gaseous products resulting in local pressure with the formation of blisters.

The authors have perfected a technique for producing sections of actual blisters and then examining them at high magnification. They quote the well-known theories of blistering, such as the formation of the brittle copper-zinc diffusion layer; inadequate cleaning; over-cleaning, etc., and go on to say that while there may be some substance in these suggestions, their experience has indicated that the occurrence of blisters appearing immediately after plating seems to be too haphazard to be related directly to the cleaning technique. The same cleaning technique may produce comparatively blister-free deposits and at other times result in copiously blistered work. Some of the more recent work suggests that discontinuities in the plate allow ingress of the corrosive atmosphere which attacks the basis metal, the corrosion product then forcing up the plate into a blister. Furthermore, it has been suggested that intergranular corrosion of the basis metal at the interface is a source of blistering. Such a condition has been found on castings which do not conform to specification in respect of magnesium, lead, tin and cadmium contents. Much of the authors' evidence falls into line with the idea that a blister is fundamentally produced as a result of local corrosion of the casting (it may occur in more than one way) and this aspect is then discussed at length. The interesting work by *Anderson* and *Reinhard*, which may be summed up as suggesting that blisters which occur after some service arise through (a) inadequate thickness of deposit which through resulting porosity encourages local atmospheric corrosion, and (b) the adverse effects of elements other than zinc which do not comply with the specification limits, has been particularly noted. The authors are unable to comment on the possibilities of (b) since the material which they employed was in all cases guaranteed to be strictly in accordance with the requirements of BSS.1004, and thus rules out the possibility of blistering from this source.

Definition of "Service" and "Process" Blisters

The two distinct types of blisters which they postulate are described as follows:

It is necessary to differentiate between those blisters forming the subject of this work and those encountered on die-castings which have seen a period of service. The authors have accordingly described the former as "Process" blisters, and the latter as "Service" blisters. The main points of difference between these two types of blisters appears to be as follows:

Process Blisters

(1) Normally encountered immediately after the completion of the plating cycle, under circumstances where over-cleaning, brittle copper diffusion layers, grease, etc., do not necessarily provide an acceptable explanation.
(2) Considerable internal pressure exists.
(3) No pores or fissures exist in the deposit.
(4) Atmospheric corrosion after plating has had no opportunity to play any part in the formation of such blisters.
(5) The condition of the surface to be plated, i.e., polished or unpolished, has a bearing on the tendency to blister.

Service Blisters

(1) Normally encountered on castings which have seen a period of some service.
(2) The deposit has a pore or fissure, or is erupted at the blister site.
(3) Atmospheric corrosion after plating has evidently played an important part in the formation of the blister.
(4) The condition of the deposit itself appears to be the primary factor in affecting the tendency to blister.

Attempts to Produce Blisters Artificially

The authors tried several techniques with a view to producing artificial blisters. Fissured surfaces were produced by the following methods:

(1) Selective etching.
(2) Selective corrosion.
(3) Production of micro cracks in surface by bending stresses.
(4) Production of capillaries by drilling or piercing.
(5) Production of a porous moulding by powder metallurgy processes.

The last method proved to be the most successful. Finely powdered zinc-base diecast alloy was employed, mixed with graphite to produce compacts under pressure (30-40 tons per sq. inch). These compacts were then plated and a close examination of the surface showed numerous blisters of varying size and shape. The actual adhesion appeared to be satisfactory. Appropriate sections were cut out for micro examination, and it then became apparent that the blis-

ters were due to structural weakness in the sub-surface layers of the compact. These blisters were inclined to be irregular in shape, whereas the authors state true process blisters are almost invariably circular, and it can be seen, therefore, that the direction and area of the planes of weakness (within the compact or casting) influence the size and shape of the blister.

An important fact emerging from this section of the work is that to permit a true process blister to develop, i.e., one produced by internal pressure from corrosion products, a relatively sound casting is necessary having no sub-surface laminations or planes of weakness. If such defects exist, rupture will occur there rather than at the interface, due either to pressure arising from corrosion products, movement during polishing, or local weakness aided by stresses in the composite deposit.

The paper is illustrated by a considerable number of micro-photographs of high magnificatoin, showing sectioned blisters, and concludes with a number of proposed methods designed to prevent the occurrence of "process" blisters.

THE PREPARATION OF SURFACES FOR ELECTRODEPOSITION AND THE INFLUENCE OF SUCH SURFACES ON THE CHARACTERISTICS OF THE DEPOSIT

Dr. A. T. Steer adds further evidence to his previously made contention that many of the troubles of electroplating are connected with the high energy of the polished metal surface. This is caused by the displacement of atoms in polishing and through slow release of strain after the plating is done, which may lead to blistering and bad adherence.

The author describes several new methods of detecting high and low energy sites on a metal surface. In one case etching is done in the oil which lies between the high power objective and the metal and can therefore be observed whilst it is happening. This method consists of taking a strip of metal about twenty-seven inches in length. The whole of this strip is immersed in a plating bath, and by means of an automatic device, is raised clear of the plating solution one inch per second, as an intermittent movement. This enables one to obtain a series of deposits, each of one inch in length, of one second difference in its period of deposition. Each one is carefully cut from the strip and is mounted absolutely square in a well compacted bakelite mounting, and is then prepared to as near a perfect metallographic polish as can be obtained.

This entails a rather specialized technique, including the manufacture of superfine abrasives free from any residual reactive ions. When each one is prepared, it is examined at 2500 to 3000 diameters, as the deposit is so minute that its section would not be visible unless such magnifications are available. The examination of each in turn will indicate two distinct features; one, how the deposit behaves in its early stages; and two, the influence of the surface towards the behavior of the deposition. On examining an initial deposit, it will be seen that the deposition is far from continuous, and portions of the surface exhibit minute growths of deposit whilst others are entirely devoid of deposit. The fact that some portions of the surface exhibit a deposition whilst others do not, indicates that conditions in one zone must differ very considerably from those in another. The problem therefore amounts to being able to distinguish these differences and to find out why they exist. Thus, having examined a series of sections of electro-deposited metals differing by only one second intervals in the periods of actual deposition, the specimens concerned are covered with immersion oil, containing one drop of reagent, and the reactivity of the surface is carefully observed.

It will be found that the zones devoid of a deposit will be slowly etched, and those with a superimposed deposit will be very slightly attacked, if at all. This at once indicates the state of the respective zones. Those which etch and reveal the substrate structure will be the zones of high energy content, whilst those which appear to be hardly affected will be in a much lower energy state. The process of examination, if carried throughout the series of depositions, will indicate the behavior of a surface during the first twenty-five seconds of deposition. The characteristics of the very early stages of deposition, viz., those of one, two, three, four or five seconds duration, will show how the zones of different energy content dominate the growth or progress of the deposit, and how robust it grows in low energy areas, whilst the high energy counterparts exhibit little or no deposit at all. Thus, Faraday's Laws are obeyed, but not in the manner which produces an equivalent thickness of deposition throughout the area of the substrate surface.

The situation amounts to this: that a definite weight of deposit must be built on to the base metal surface in a given time, but this can be effected by selective deposition of a relatively thick nature, or can take place in a uniform manner but be of a much thinner dimension. In each case an equivalent number of metallic atoms would be captured and retained by the surface, but the characteristics of each deposition would differ very considerably. The high energy zones are those exhibiting a distorted atom configuration, which in an extreme case would be completely random, but in most cases appears to be composed of fragmentary crystalline matter, with the fragments of the original crystals laying in a very disordered arrangement. This can be termed a "partial Beilby layer," for it is not wholly crystalline or completely random, and for want of a better description can be referred to as a partially formed flow layer. The zones of low energy content (which are not necessarily those of minimum energy) are composed of crystalline matter, but the fact which is most important is that the degree of energy content is considerably lower than in the case of the distorted material referred to above. Thus, when metallic atoms are formed at the surface, those zones of low energy content provide an easy linkage with the base metal structure, whilst the highly distorted material does not.

Electrolytic Polishing of Metallic Surfaces—Part III

By Dr. Pierre A. Jacquet, *Ingénieur-Chimiste I.C.P., Docteur de l'Université de Paris, France.*

Introduction

IN A preceding article we have indicated the fundamental basis of electrolytic polishing, given a few possibilities of its possible if not certain mechanism, and traced in a larger sense the conditions which allow its realization on a large number of metals and alloys.

It is now expedient to present the fields of application of this new method for finishing metal surfaces. These fields may be divided into two large groups: one group is concerned primarily with scientific or laboratory applications; the other the field of industrial applications in the transformation and use of metallic materials.

The interest in electrolytic polishing for scientific studies of the metallic state naturally follows the interest in the physico-chemical and microgeometric characteristics of the surfaces thus obtained. These characteristics seem to be of lesser value in practice, but in reality this is true only in those cases where the polishing has just the goal of conferring an agreeable appearance to the metal objects, in which case electrolytic polishing is substituted for mechanical polishing with certain technical and economic advantages. Quite to the contrary, examples are recognized where the proper character of the electrolytically polished surface is directly responsible for conferring to the metal special properties of which the industry is greatly interested in taking advantage. Otherwise the future of technical experimentation would be limited to the "decorative polishing."

The States of Metal Surfaces

In order to understand the fundamental differences which exist between two polished surfaces of the same metal, one polished by the traditional mechanical method and the other polished by means of electrolysis, we must call upon a very important idea which was formerly suspected as a result of the work of *Osmond* in France,[1] of *Sir George Beilby* in England[2] and others, but stated considerably more correctly in the light of modern methods of micrography, electron diffraction and X-ray diffraction.

Under the expression "state of the surface" are covered all of the characteristics which allows as exact a definition of the surface of the metal as possible. These characteristics are of three types: 1) microgeometric characteristics which concern the qualifying of the micro-profile, or in other words the quantitative distribution of the "valleys" and "peaks"; 2) physical characteristics, or the structure of the crystal lattice and network and the properties directly derived from them, such as the superficial stresses; 3) chemical characteristics which comprise the nature, form and locations of the elements or chemical compounds other than those directly pertaining to the metal under consideration. Often, as a matter of simplification, the two latter groups of characteristics, physical and chemical, are combined under the expression "physico-chemical" state of the surface.

In order to exactly define a metallic surface it is thus necessary to know the microgeometric or physico-chemical characteristics, or "state of the surface." For a long time, in fact up until a relatively recent date, the problem of metallic surfaces had been treated much more simply. In effect, each investigator only attached importance to a certain characteristic, ignoring or wishing to ignore all of the others. Thus the mechanic would consider only the microgeometry or the "finish" of the pieces which he proposed to mount in a motor or a machine and the finishing of which involved mechanical methods such as machining in a lathe, grinding on an emery wheel, honing, lapping, etc. The physicist studied the properties of a metal without attaching any special importance to its surface, searching only to realize the most favorable state for observations (for example polishing for the study of the optical properties). Finally, the chemists examined the nature of the compounds arising on a metal submitted to a reagent or a medium of attack, and looking for the laws governing these processes of corrosion. He considered the metal as completely homogeneous although the phenomena set to work concerned the most superficial layers at first, and not the mass below.

Physico-Chemical Nature of Mechanically Polished Surfaces

Physical Structure

Much of the research on the properties of metals used mechanically polished test pieces. A polished

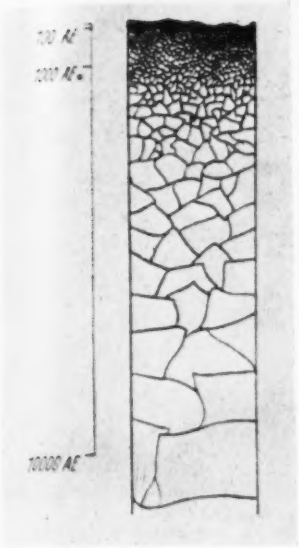


Figure 12. Schematic diagram of the superficial structure of a monocrystal of copper subjected to 30 minutes burnishing, deduced from electron diffraction diagrams.

surface, in effect, facilitated the observations and many investigators imagined that this state was well defined and reproducible. Now, however, it is known that the different stages of mechanical polishing more or less modify the structure and thus the superficial properties of the metal. The stages of polishing are composed of roughing down (rectification, grinding, abrasion, etc.) which succeed in giving the surface a more or less smooth microprofile, and finishing, using extremely fine abrasives (English rouge, alumina, magnesia) supported by very soft materials (felt, cloth, chamois). We will examine the transformations which the metal undergoes in the course of each of these different stages.

Work with tools or coarse abrasives brings to play the mechanical effects of tearing, wearing and rubbing, which causes a fracture of the crystals of the metal to fragments or crystallites the size of which is smaller as they are closer to the surface. The crystals situated deeper in the metal escape this action. This destructive effect is easily observed on a metallic monocrystal when it is subjected to abrasion with coarse emery paper. The X-ray diagrams no longer give the spots of a monocrystal, but the characteristic ring of an agglomerate of small crystals[3]. Electron diffraction confirms these results.[4]

Polycrystalline metals are less sensitive than the monocrystals to the mechanical action because the intergranular joints oppose the transmission of the deformation, to a certain extent. However special micrographic methods show the superficial layer disturbed by abrasion in such metals as iron, copper, zinc, tin, magnesium, and many alloys (brass, tin bronze, aluminum bronze).

Besides the mechanical effects, the first stages of polishing are accompanied by thermal effects due to the friction of the tools and the abrasives on the surface. Certainly these thermal effects contribute to disturbing the structure by causing a partial or total recrystallization or a growth of microcrystals. The evolution of heat also favors superficial oxidation, to which microcrystals of various orientations, such as is precisely the case of surfaces subjected to abrasion, are extremely sensitive.

The ultimate stages of polishing, which confer a very smooth and brilliant surface, bring into play a mechanism probably different than abrasion, but not well known. Even though the roughing down proceeds by wearing and tearing of the irregularities on the surface, the disappearance of the micro-irregularities under the friction of the polishing agents would result from the flow or smearing of the most superficial layer in such a way as to distribute the material over the entire geometric plan.

The exact mechanism of the final stage which constitutes *true polishing* has been previously studied by *Sir George Beilby*, who had proposed the formation of a superficial "amorphous" layer which covered all of the "microvalleys" as a sort of a "bridge." The existence of this very thin film of matter stretched over the surface is remarkably shown by the experiment of Beilby, well known to metallographers, consisting of chemical etching of a well polished surface. This attack sometimes causes the reappearance of the scratches resulting from the previous stages of grinding, and which were completely invisible before the chemical attack.

Modern studies, especially by means of electron diffraction, do not seem to confirm the existence of the amorphous layer of Beilby, but lead to the conclusion that the surface of a polished metal is composed of extremely fine microcrystals, or in other words the atoms are not randomly distributed as in a liquid, but follow a crystalline pattern characteristic of the metal under consideration.

In summary, the structure of a metal subjected to mechanical roughing operations (abrasion for example) then polishing, may be schematically illustrated by Figure 12, where the succession of disturbed crystalline layers which form the transition between the micro-crystals (of lowest height at the surface) and the normal crystals in the mass of the specimen may be seen. The thickness of the abnormal layer, and the size and eventual orientation of the crystals of which it is composed evidently vary with the metal and its initial state, and also the conditions of the mechanical treatment (coarseness of the abrasives, speed of the tools or wheels, pressure and duration of friction, etc.). Not all of the other characteristics of mechanically polished surfaces are illustrated on the diagram of Figure 12, such as films of oxide, or mechanical stresses which generally accompany the structural modifications.

In order to make the mechanical and thermal effects of abrasion evident a few micrographs will be shown, typical of the structural disturbances accompanying the mechanical polishing of brass, steel, and magnesium. All of these micrographs were obtained through the use of electrolytic polishing which allows on one hand the evasion of unwanted disturbance during the preparation of the sections (in the case where the examination has as its goal the simultaneous study of the succession of zones from the extreme surface), and on the other hand the solution of the layers across the metal (in the case where the examination is made on the same surface).

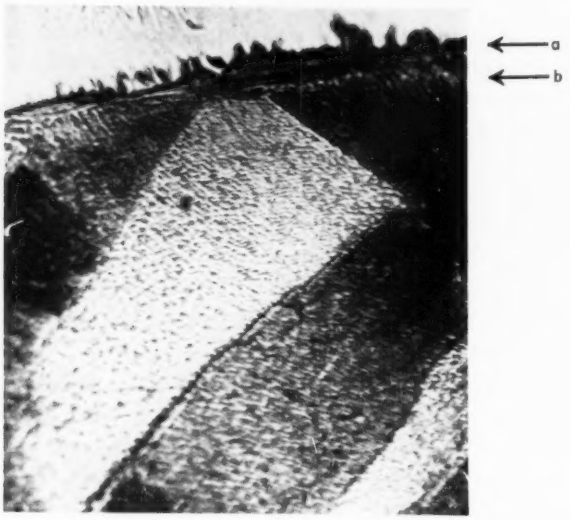


Figure 13. 70-30 Brass polished mechanically on emery papers and alumina. Section normal to the surface, polished electrolytically and etched by reducing the voltage of the cell. Magnification 500x. a) Surface. b) Lower limit of cold-worked zone.

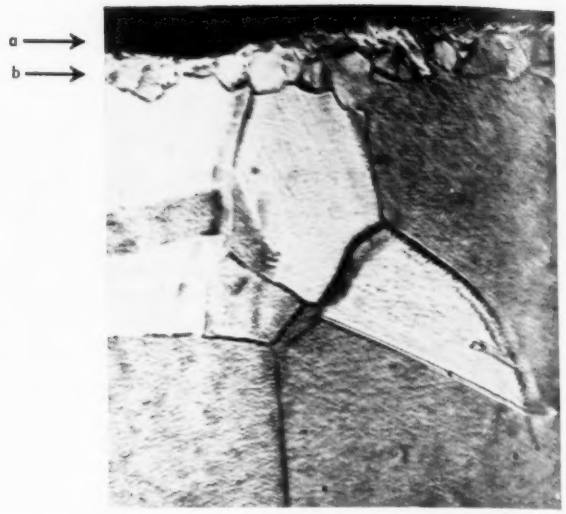


Figure 14. Same sample as Figure 13, annealed 1 hr. at 280°C., electrolytic polished and etched. Magnification 500x. a) Surface. b) Lower limit of cold-worked and crystallized zone.

Brass[5]

Figure 13 shows the section of a plate of brass, the surface of which has been ground with the series of abrasive papers used in routine micrographic polishing. Electrolytic etching of this section causes the appearance of a zone which differs in aspect from the portion away from the surface. The deformation is clearly distinguished from the bordering large crystals occupying the center of the figure. If the mechanical polishing is followed by annealing (1 hr. at 280°C.) the disturbed layer recrystallizes, as indicated in Figure 14.

Dance & Norris[6] have recently studied the structural disturbances of abraded brass by measuring the *microhardness* of the sections, performed not perpendicular to the surface, as in our experiments described above, but at a small angle, which gives an enlarged image in the sense of the depth of the surface. The measures of microhardness and the micrographs show the deformed and recrystallized layers.

Steel[7]

Progressive electrolytic polishing of a surface of steel abraded with emery paper shows a cold-deformed layer extending to a depth of several microns, and which only involves the ferrite crystals, the harder perlite not appearing to be modified (Figures 15a and 15b). Evaluation of the disturbed layer of steel is easy on an oblique section with respect to the worked surface (Figure 16). The section also shows the ridges produced by the abrasion.

Magnesium[8]

It is only necessary to submit a specimen of magnesium containing very large crystals to abrasion with very fine (no. 3/0) emery paper in order to cause the formation of a superficial layer composed of very small crystals to a depth of the order of 1 to 2 microns, with strongly deformed large crystals further down. In spite of the mild conditions of abrasion, the local elevation of temperature is sufficient to cause recrystallization on the surface of the disturbed metal. The larger the grain of the abrasive, the more severe is the disturbance. (Figure 17).

Tin[9]

Tin behaves like magnesium, but the thickness of the perturbed layer is much greater, even when the polishing is done with an abrasive paper of very fine grain. Figure 18 shows the cold working of pure tin to be present even after dissolving a layer of 16 microns. Twinned crystals and small crystals from recrystallization are observable. The presence of 0.5% of antimony suffices to raise the temperature of recrystallization so that the disturbed zone contains only twins in the interior of large deformed crystals. The extreme sensitivity of tin to cold working by abrasion makes it very difficult to obtain correct micrographs by means of the traditional polishing method.

Chemical Nature

Rubbing metallic surfaces with abrasives in the presence of air or in a medium of water involves oxidation, the intensity of which depends upon the degree to which the metal is oxidizable. Abrasion conducted in vacuum, on the contrary, seems to give an unoxidized surface.[10] The microcrystals resulting from the destruction and breaking up of the normal grains of metal are probably more sensitive to oxidation. Chemical impurities other than the oxides may exist on mechanically polished surfaces; for example, polished metals retain particles of abrasives imbedded in the surface. In the first stages of electrolytic polishing it is frequently noticed that a solid film, which is only a film of oxide and superficial impurities formed during the mechanical finishing with abrasive paper or on contact with the air, is removed. The most clearly observed examples are with copper or aluminum, both easily-oxidized metals. These films of natural oxidation have been isolated and studied

for the first time by *Evans*, *Vernon* and their collaborators.[11]

The chemical nature of a surface polished mechanically is thus, like its structural characteristics, poorly defined and not reproducible, from whence come the properties which are not truly those of the metal. Thus, as we will see, mechanically polished aluminum in numerous cases shows the properties of alumina, since the film of oxide has not been removed.

The three groups of characteristics which define the state of the surface, namely, the microgeometric, physical and chemical characteristics, form a unit and cannot be separated. The chemical state of the surface depends upon the microgeometric and structural characteristics. In the same sense the physical and microgeometric characteristics mutually influence each other.

It is important to emphasize that many of the methods of investigation which are at the hands of the physicist and the metallographer for studying a metal (X-ray and electron diffraction, optical properties, magnetic properties, electrochemical properties, etc.) use to various extents the external surface of the metal in contact with an external medium. Thus, that which is often considered to be a property of the metal is in reality more or less representative of the surface only, and corresponds to the complex ensemble, which may be schematically represented by the expression:

METAL + (Microgeometric, Chemical and Physical states of the surface)

This explains why the values experimentally obtained in the study of certain properties are only approximate measures, and moreover are poorly reproducible (the optical constants, for example).

Figure 15a. Effect of abrasion on the surface structure of .30 carbon steel. Surface ground on a No. 2 emery disc. Structure after short electropolishing which dissolved 2 microns of metal. The large ferrite crystals are divided into numerous crystallites. Pearlite is not disturbed. Magnification 700x.

Figure 15b. Same as Figure 15a, after electropolishing long enough to remove 7 microns of metal. Complete elimination of abnormal layer. Magnification 400x.

Physicists have quite often considered the first term of the complex, the metal, to be completely homogeneous, neglecting the factors which characterize the state of the surface, the precise knowledge of which requires a particular analysis.

The study of the phenomena of great technical importance, such as oxidation, corrosion, friction, and wear, which concern the surface of the metal and the immediately adjacent zones, requires the exact definition of the microgeometric characteristics and the physico-chemical properties.

Nature of Electrolytically Polished Surfaces

The considerations which have just been discussed were found, confirmed and stated exactly when physicists and metallographists became interested in the electrolytic polishing method. It allows, in effect, the preparation of surfaces in which all of the characteristics are well defined and reproducible. The smooth and brilliant surface obtained by electropolishing quite often corresponds to bare metal, depending upon its structure and chemical nature, but certain electrolytic techniques, although eliminating the layer disturbed by the mechanical action of tools and abrasives, causes the formation of a superficial film of oxide. A well known example is that of aluminum: an acetic-perchloric polishing bath gives a surface corresponding practically to metal (see later) but fluoboric, phosphochromic and alkaline (Brytal, Alzak, etc.) electrolytes lead to aluminum covered with a film of oxide. This explains why certain authors have written that electrolytically polished surfaces are "passivated." It is necessary to say, in truth, that certain anodic polishing processes give surfaces which are "active" while others give "passive" surfaces.

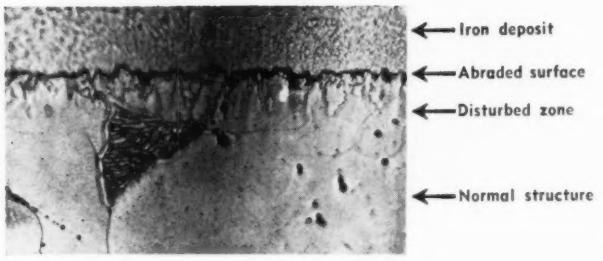


Figure 16. Taper section of carbon steel, surface of which was ground with No. 1 emery paper. Horizontal magnification 1000x; vertical magnification 4000x. The disturbed zone has a thickness of 2-3 microns. Micrograph obtained by electropolishing the oblique section after plating with iron. Picral etch.

A distinction should also be made between the passivity acquired during the polishing and the passivity which appears when the surface is removed from the bath and exposed to an external medium (water or air). Thus, aluminum treated in an acetoperchloric mixture is active but is covered very quickly (just because it is active) with a very thin film of oxide as soon as it is in contact with humid air.

Those considerations which bear on the true nature of electrolytically polished surfaces will be considered later. For the present it will suffice to state that the solution of a metal in an anodic polishing bath, whatever the initial state of the surface, reduces the ridges, and eliminates abnormal layers of structure or chemical impurity to give a bright and brilliant surface whose properties are *generally* those of the metal.

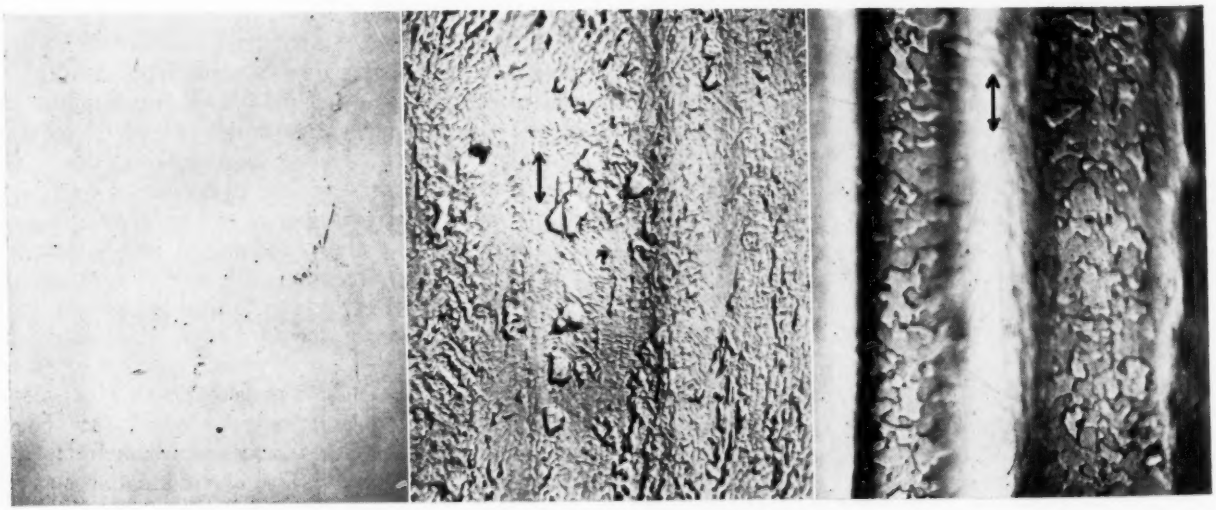
Before the discovery of the phenomenon of electrolytic polishing only two types of metallic surfaces were well defined. These were: a) the thin films obtained by cathodic projection or evaporation under vacuum, and b) mechanically polished surfaces treated at high temperatures in vacuum or in hydrogen. The mirrors deposited in vacuum on the surface of glass had only limited interest, due to the fact that interest was centered on the properties of massive metals prepared by the normal metallurgy techniques. Annealing under vacuum or in hydrogen caused certain effects of mechanical polishing to disappear, but it also caused at the same time structural modifications such as the recrystallization of the superficial layer, as we have shown with brass, of such a type that the material does not agree exactly with its initial state. Further, certain chemical impurities on the surface of the metal are somewhat diffused through the adjacent metal.

A systematic study of a large number of properties of metallic surfaces made comparatively on metals polished mechanically and electrolytically almost always revealed considerable differences, which resulted in the principles which have just been discussed. The results of these studies contributed new data of great scientific interest and technological value. It is these results which will now be discussed.

Applications of Electrolytic Polishing to Micrography

The field of micrography, or the observation of the microscopic and ultramicroscopic structure of metals and alloys, is the largest field of application of this new method of polishing. This application was developed in the metallurgical research and control laboratories.

The classical technique of polishing specimens for microscopic examination has not advanced since the fundamental work of the pioneers of metallography at the end of the 19th and beginning of the 20th centuries (Sorby, Le Chatelier, Osmond, etc). The technique developed by these men involved the specular polishing of the surface with finer and finer abrasives, then etching by means of reagents designed to dissolve the superficial layer and reveal the details of structure (intercrystalline boundaries, phases or constituents of alloys, insoluble impurities in the



a b c

Figure 17. Surface structural disturbances in very pure magnesium (99.99%) subjected to abrasion.
a) Original surface electropolished and etched in dilute acetic acid. 250x.
b) Surface electropolished then rubbed with No. 3/0 paraffined emery paper. Electrolytic solution of a layer of 1 micron thickness. Etched in dilute acetic acid. 1000x.
c) Surface electropolished then rubbed with No. 2 emery paper. Electrolytic solution of about 2 microns. Etched in dilute acetic acid. Arrows indicate direction of scratches from abrasion. 600x.

metals, non-metallic inclusions, fissures, etc.). Mechanical polishing is a long operation which must be done with great care to reduce to a minimum the disturbed layer and not to leave any annoying unevenness. Even when taking the greatest precautions it often happens, for example with milled metals, that the great sensitivity of the metal to cold working and to crystallization does not allow the investigator to be absolutely certain that the observed structure is that of the normal metal. Metallographists are familiar with the false structures observed in stainless steels where abrasion causes the transformation of gamma iron to alpha iron.[12]

Another cause of difficulties and error lies in the corrosive action of the etching reagents, which give auxiliary images that mask the very fine details of the structure.

These latter inconveniences, more or less easy to avoid by the operating methods which form "the art of metallography," do not exist when electrolytic polishing is applied to the preparation of the samples. It is not possible in the scope of this article to describe the elaborate operating methods for micrography, and in the same sense it will not be possible to divulge the results obtained, for to do so would require the analysis of about 150 articles! To show the practical value of the new method, only the advantages recognized by the majority of the specialists will be summarized. The reader will find under reference[13] in the bibliography a list of the most important articles.

Ease of Execution

Electrolytic polishing processes adapted to micrography use simple and inexpensive apparatus, the handling of which may be assigned to unspecialized personnel. In both the United States and Scandinavia commercial apparatus specially designed for the rapid polishing of small specimens is available.[14]

Speed

Starting with a surface prepared by sanding with number 0 to 3/0 emery paper, complete polishing takes only a few minutes of electrolysis. Furthermore, several samples may be treated simultaneously in the same bath. Special methods have been devised to further reduce the duration of treatment to less than a minute or even to a few seconds, starting with surfaces grossly prepared with a file, (method of *Kuhn*, *De Sy-Haemers*, *Knuth-Winterfeldt*).

Possibility of Polishing Samples of Any Shape or Form

Mechanical polishing is only possible on a single plane face of the sample in one operation. The anodic method allows the simultaneous polishing of all of the faces of the sample which may measure several square centimeters or even about ten square centimeters. The polishing of non-planar surfaces is equally possible. Sheet metal may be polished without special mounting. For objects of very large volume, such as pieces of machines, the method of *Knuth-Winterfeldt* allows the polishing of very small sections (1 to 2 square millimeters) located at any point. This is very interesting for non-destructive control tests. An ingenious procedure, "brush electropolishing," devised by *Mazia*[15] also allows the polishing of large surfaces with a limited current source. It will later be seen that "electrolytic superfinishing," conducted on an industrial scale in France, leads to the finishing of the surface with the simultaneous control of both macro and micrographic structure.

Illustration of the Real Structure

When examining a surface prepared for micrography under the microscope, the metallurgist is sometimes confronted with the following question: does the observed image really correspond to the proper structure of the material? The reason for this is, as we have already noted, that all of the mechanical actions which accompany the preparation of the sample, result in more or less disturbance of the true structure, and the investigator is not always sure that the abnormal layer has been dissolved during the etching. Figures 13, 15a, 16, 17b, 17c, 18b and 18c, show a few of these false structures exhibited on the surface or in a cut perpendicular to the surface. Figures 15b, 17a, 18a, 19, and 20 correspond to the true structures obtained by electrolytic polishing of the same samples. It is remarkable that in the case of magnesium and tin, the weak abrasion produced by very fine emery paper suffices to modify the structure completely. In particular, the twins penetrate very far into the interior of the metal.

Crystallographic disturbances are not the only effects of mechanical polishing; friction of the abrasives may break fragile constituents to very small particles. A typical example of this is that of the inclusions of cuprous oxide in copper: 25-30% of these inclusions are eliminated from an electrolytically polished surface by simply rubbing with a piece of chamois covered with alumina in aqueous suspension.

Demonstration of Structural Details

Thanks to the perfection of the polish and the absence of corrosion, the fine details of the micrographic structure which are very difficult or even impossible to detect with the classical methods, are very clearly shown on electrolytically treated surfaces. It is important to emphasize that electrolytic polishing only gives a very smooth and brilliant surface with *pure metals and with monophase homogeneous alloys.* All heterogeneity, physical or chemical, regardless of its nature or size, is thus visible. This makes research on heterogenous systems particularly easy; traces of insoluble impurities (sulfur, bismuth, lead, oxides, etc.) in metals; carbides in steel and iron; minimum proportions of constituents and phases in

alloys (beta constituents in brass, aluminum-magnesium alloys, etc); heterogeneities of chemical composition in solid solutions.

Electrolytic polishing allows the solution of certain practical problems concerning a) localization of the impurities at the boundaries of the grains b) the influence of heterogeneity on the formation of anodic oxidation layers on aluminum and light alloys[16]; c) the start of precipitation in alloys in the course of thermal treatment.

Since the finest heterogeneities appear as a result of electrolytic polishing, a metallographic specimen thus prepared will show, quite often but not always, many more details than a mechanically prepared surface. For this reason certain metallurgists say that electrolytic polishing exaggerates the defects. In reality this is not correct, but it is true that the physical defects (fissures, porosities, microporosity) are exaggerated with respect to their size; a fissure is enlarged, for example. Admitting this magnification, nevertheless it can present an advantage. Thus a fissure or pin hole too fine to be seen with mechanical polishing (which tends to cover it by flowing and smearing of the surface metal) becomes larger or deeper and therefore visible.

Possibility of Using Very Sensitive Etching Methods

Etching with a chemical reagent is almost always necessary to reveal the structure of a mechanically polished sample, but it is not so with electrolytic polishing, since many of the structural heterogeneities appear directly. However, an etch is useful to show the crystal boundaries and the cold working pheomena. For this purpose the classical reagents may be used as well as the special methods of extreme sensitivity; anodic oxidation for aluminum and light alloys; the formation of corrosion figures on iron and aluminum crystals; etching by short circuiting the electrodes at the end of the polishing of copper, zinc and brass (a method well adapted to show the boundaries and traces of plastic deformation); rapid immersion of copper in ammonium sulfide, which gives excellent color micrographs. The latter reagent gives no results on mechanically polished surfaces, for these become uniformly covered by a layer of copper sulfide, which once again demonstrates the cold worked surface.

In metallurgical laboratories the microscope is not used solely for the examination of structures, but it constitutes in addition a fundamental tool for special research. The nature of electrolytically polished surfaces and the quality of the polish greatly extend its field of application. Note for example, the study of plastic deformation by the observation of the slip bands[17]; the study of the formation and the defects in anodic oxidation films on aluminum and its alloys; the determination of microhardness (see later); the examination of designs of corrosion and evaporation[18], etc.

The preparation of samples for examination in the electron microscope by the impression method quite often depends upon anodic polishing, for it is important to obtain specimens free from deformation and corrosion.

In summary, electrolytic polishing has many advantages over the classical mechanical methods for micrography. The economic advantages (speed, low cost, etc.) are valuable for manufacturing control, since the tests may be made more frequently. The technical advantages are particularly appreciated in the research laboratories. *(To Be Continued)*

(References will appear in a future issue.)

Abrasive Methods—Surface Treatments—Control
Electroplating—Cleaning—Pickling—Testing

Shop Problems

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Acid Gold Plating Baths

Question: Is there any way to plate gold except from the usual gold cyanide complex? I have heard of acid gold baths, but have never seen any formulas. Can you supply any information on such baths?

R. J. F.

Answer: Acid gold baths have been quite widely used for heavy, non-decorative type plating. A flash in a regular gold cyanide bath is usually recommended before transferring the parts to the acid gold bath, however. A typical acid gold formula is as follows:

Gold Chloride	6 oz./gal.
Hydrochloric Acid	10 "
Temp.	75°F.
Current Density	5 A./ft.²
Anodes	24 K. Gold

Another bath, called a "salt water gold" is as follows:

Gold Chloride	6 dwt./gal.
Potassium Ferrocyanide	2 oz./gal.
Disodium Phosphate	1 "
Sodium Carbonate	½ "
Sodium Thiosulfate	.02 "

Boil the solution for 30 minutes and filter. Place the filtrate in a porus pot immersed in an outer tank containing saturated sodium chloride solution at 160°F. Immerse a sheet of zinc in the sodium chloride bath and attach a wire from this zinc sheet to the article to be plated, which is immersed in the gold solution inside the porus pot. No current is required. The deposits obtained by this method are very thin. The gold content of the solution is replenished by using a stock gold solution, making additions as required.

Plating on Stainless Steel

Question: We often run into difficulty with poor adhesion when we try to plate on stainless steel. We are using a rochelle copper strike, copper plate, nickel plate, and chrome cycle, with the usual rinses and dips. Can you suggest a way out of our problem?

F. T. N.

Answer: The best method for plating on stainless and other high alloy steels is to use a strike from a nickel bath containing a high percentage of chlorides. One such formula is as follows:

Nickel Chloride	30-35 oz./gal.
Boric Acid	4-6 "
Hydrochloric Acid	10% by vol.

This bath is operated at room temp. at about 20-40 ASF. You can then proceed directly to the regular nickel bath to build up the bulk of the nickel deposit. About 3-5 minutes in the strike should be sufficient for most articles. This method is also used for nickel plating over previous nickel deposits without having to strip off the old coating completely. An activating treatment may be required in such cases for the previous nickel deposit.

Bright Zinc Finish

Question: We have recently seen a sample of plating that was very bright and lustrous, very much like buffed chromium. We were told that it was a zinc plate, and would like to know what type of plating bath is used to produce this type of deposit?

I. D. N.

Answer: In our opinion, the parts that you saw were probably first zinc plated, then treated in one of the bright dips which are marketed by several firms. If the parts were first highly buffed, this brightening treatment will produce a lustrous, chrome-like finish, although somewhat whiter than chrome plate. The names of firms who can supply these materials are being sent to you.

Cleaning Die Compounds from Brass Forgings

Question: We have a problem in cleaning the graphite-tallow compounds from our brass forgings. The mixture seems to "burn" into the metal surface and is very difficulty to remove. Can you suggest a method for doing this job economically?

P. P. S.

Answer: Burned in graphite mixtures cannot be dissolved from metal surfaces in the usual acid dips, and sand blasting or liquid abrasive blasting would seem to be the best method. Another method which can be used is to anneal the brass forgings in an oxidizing atmosphere. This oxidized surface will include the graphite and burned tallow that does not vaporize, and the black oxide can then be removed in the usual de-scaling pickles commonly used for brass.

Blackening Cast Iron

Question: Can you give me a formula that will successfully blacken cast iron stove parts? I have tried several of the commercial preparations but have had very little success in obtaining a good black.

E. W. A.

Answer: A formula which has been proposed for blackening cast iron is as follows:

Copper Sulfate	8 parts by wt.
Nitric Acid	15 " " "
Ethyl Alcohol	30 " " "

The parts are first thoroughly degreased, then immersed in the bath until the color develops sufficiently. They are then rinsed, air dried, and rubbed with an oily cloth. Several of

the suppliers of proprietary blackening baths for steel may be able to suggest modifications that will overcome your difficulty, and the name of a firm making a special black bath for cast iron is being sent to you.

Cadmium vs. Zinc vs. Tin for Salt Spray Resistance

Question: Has there been any published work on the comparative salt spray resistance of equal thicknesses of cadmium, zinc, and tin plating on high carbon steel? We are also interested on their relative rates of hydrogen absorption during plating.

J. F. R.

Answer: A very comprehensive report on this subject will be found in the Proceedings of the American Society for Testing Materials, Volume 47, 1947, p. 782. This report covers such subjects as fatigue endurance, salt spray resistance, and resistance to higher temperatures of coatings of these three metals in thicknesses of about .0003". Other important characteristics of the three metals are described, including some remarks on the relative costs for plating of each.

Sludge Formation in Black Nickel Plating

Question: Recently we have noticed that our black nickel bath is accumulating considerable sludge. What could be causing this trouble, which seems to come and go for no apparent reason?

A. E. E.

Answer: The sludge is probably basic salts of zinc, which precipitate when the pH gets too high. This should be checked and maintained at about 5.6-5.1. You should also check to see if you are dragging in any alkaline materials from your cleaning cycle. Test some of the drippings from the work just prior to immersing in the black solution with a piece of litmus or pH paper.

Agitation in Bright Nickel Baths

Question: We have been experiencing some trouble with the air blower used to agitate our bright nickel bath, in that oil has been getting into the air lines and bath, causing pinholes in our plating. Can you suggest a better way to do this job?

E. L. G.

Answer: Air compressors should not be used as a source of air for agitating bright nickel baths, as it is almost impossible to prevent some oil being introduced into the plating bath. Circulation of the solution by means of a pump is considered the best method of agitation, as this eliminates the introduction of air bubbles in the bath entirely. The pump unit on most commercial plating filters can be used for the purpose, provided it has the proper valving and capacity, or "turn-over rate." If air agitation must be used, a blower should be used in place of a compressor, and adequate line filters for removing any dust or oil from the air should be installed in the lines leading to the plating bath. The names of firms who can supply blowers and line filters are being sent to you.

Concentrated Plating Solutions

Question: Can you tell us if it is possible to purchase concentrated solutions for plating that require only dilution to be ready for use? We are interested in brass, bronze, copper, tin, cadmium, and zinc, and would require only about 5 gallons of finished plating solution at a time.

J. E. W.

Answer: Fluoborate plating solutions for copper, zinc, tin, and cadmium are available in concentrated form, but the others are not. The name of the supplier of these materials is being sent to you, and you will have to inquire as to the smallest amount of concentrate that they would be willing to ship at any one time.

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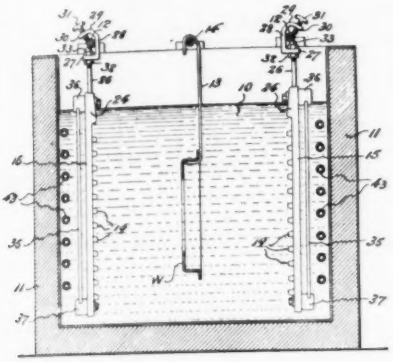
PATENTS

Plating Anode

U. S. Patent 2,462,968. *Geo. B. Hogaboom, Jr., & Nathaniel Hall.*

An electroplating anode comprising a main body plate having stiffening



ribs projecting from its work-opposing face along its longitudinal marginal portions, said plate having a multiplicity of projections integral therewith and distributively spaced over the work opposing face, said projections being of polygonal cross sectional shape to provide sharp edges at the junctures of its faces, said body plate having openings in longitudinal relation to and beneath said projections, said openings being of inverted pyramidal form and of polygonal cross sectional shape, with faces extending in common plane with co-incident faces of said projections, whereby side and end bordering sharp edges of said projections and free edges of said openings and of said stiffening ribs provide a considerable extent of current discharge lines said projections on the anode front face being adapted to prevent gas blanketing while the contiguous through openings cause some gas flow to move through the anode to the back thereof, an impervious shield attached to the anode body plate, said shield being made of non-conductive material and corresponding in area to the back face area of the anode body plate, hanger rod means affixed to the upper end portion of said plate body, and clamp hook means affixed to said hanger rod means whereby to suspend the anode.

Barrel Finishing

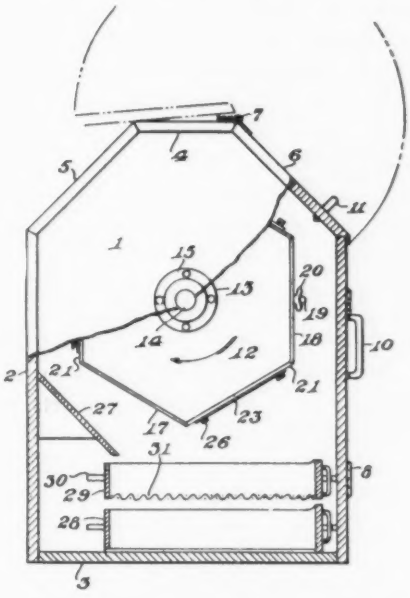
U. S. Patent 2,464,486. *Carl H. Castle, assignor to Sturgis Prod. Co.*

In a method of polishing, the steps of tumbling the work with fragments of rock and a solution of a soluble soap and a soluble metallic compound adapted to react with the soluble soap to precipitate an insoluble soap, and continuing the tumbling after the fragments are coated with said insoluble soap.

Tumbling Barrel

U. S. Patent 2,465,632. *Paul P. Burns.*

A tumble barrel, comprising a casing which in turn comprises substantially vertical bottom, front, rear and side walls topped by a polygonally shaped covering wall, said front wall being composed of hinged doors and one of the sections of said covering wall being a hinged closure, a plurality



of independently slidable drawers in the lower portion of said casing, the upper drawer having an apertured bottom and the lowermost drawer having an imperforate bottom, a shaft extending through and rotatable with respect to said end walls, a polygonally shaped tumble barrel mounted to rotate upon the axis of said shaft, one of the flat sections of said tumble barrel being removable for insertion and withdrawal of articles, others of said flat sections being provided with apertures, slidably mounted apertured gratings carried by said last-mentioned flat sections, means to secure said gratings in such positions as to predetermine the effective sizes of the apertures in the corresponding sides of the barrel, and means within said casing to deflect the fall of particles from said barrel to the uppermost of said drawers.

Buffing Wheel

U. S. Patent 2,460,588. *John F. Leslie.*

A buffing wheel comprising a metal plate having a central mounting aperture and a plurality of integral inwardly return-bent hooks spaced uniformly about the margin of the plate and equally spaced from said aperture, a plurality of fabric buffing members, a metal eye member carried by the center of each fabric member for reception by a plate hook, and a retainer plate bearing against said first plate with its margin adjacent the mouths of said hooks to prevent disengagement of said hook and eye.

Zinc Plating

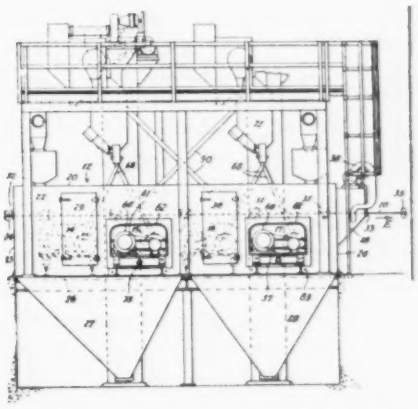
U. S. Patent 2,461,809. *Allen E. Chester and Frederich F. Reisinger, assignors to Poor & Co.*

The method of depositing zinc which comprises electrodepositing zinc from an aqueous alkaline cyanide-zinc plating bath containing a sufficient amount of dissolved product of the reaction of piperonyl aldehyde and an aldonic acid to enhance brightness.

Continuous Blast Cleaning of Strip or Sheets

U. S. Patent 2,465,360. *Gilbert D. Dill, assignor to American Wheelabrator & Equipment Corp.*

In blast-treating apparatus, a cabi-



net having entrance and exit walls, a path for continuous strip or sheet stock including a central rail or skid extending substantially from entrance to exit, side guides having recesses to receive the edges of said strip, said side guides being laterally spaced from said cen-

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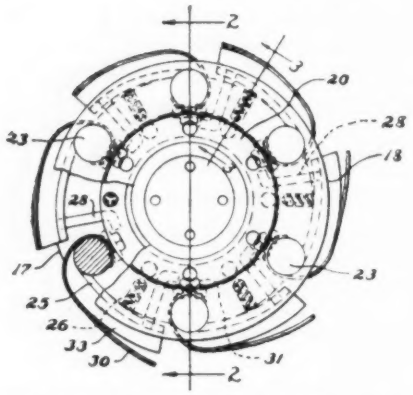
tral rail or skid, said side guides being spaced longitudinally from each other, whereby to expose said strip to the blast, and means for blasting said strip.

Abrasive Polishing Wheel

U. S. Patent 2,465,225. *Urban C. Haren, assignor to The B. F. Goodrich Co.*

A polishing wheel comprising a rotatable support having spaced apart radial flanges, one flange being removably secured thereto, said flanges having aligned apertures therethrough at spaced apart positions thereabout, rods



pivotally retained in said apertures, each rod having a relatively stiff polishing shoe secured thereto and adapted to swing arcuately thereof, a pad of resilient rubber-like material secured to said shoe for supporting and cushioning a strip of abrasive sheet material, spring means for urging said shoe outwardly, and means for limiting movement of said shoe, said spring means including means for retaining said abrasive sheet material on said shoe.

Diffused Indium-Copper Bearings

U. S. Patent 2,465,329. *William S. Murray, assignor to The Indium Corp. of America.*

The process of making a bearing which comprises forming a copper-clad steel, shaping the same into a bearing, applying indium thereon and diffusing a part of the indium into the copper by heating to a temperature above the fusing point of indium and well below that of copper, leaving a softer surface portion in which the indium is not fully diffused into the copper and which therefore is softer and higher in indium content than an underlying portion.

Chemical Oxide Films on Aluminum

U. S. Patent 2,464,596. *Ralph B. Mason, assignor to Aluminum Co. of America.*

The method of chemically forming an oxide coating on aluminum surfaces which comprises treating said surface with an aqueous solution containing, as the active coating formers 0.5 to 6 per cent by weight of alkali metal carbonate and 0.2 to 5 per cent by weight of polyvinyl alcohol.

Plating Lead-Antimony-Tin Alloys

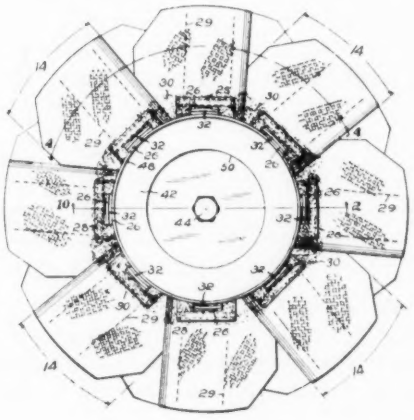
U. S. Patent 2,461,350. *Ralph A. Schaefer and James B. Mohler, assignors to Cleveland Graphite Bronze Co.*

A method of electroplating an alloy of approximately 12.2% antimony, 1%-2% tin and the balance lead which consists of electrodepositing the alloy from an aqueous bath consisting essentially of fluoboric acid (42%) 189 grams per liter of bath, basic lead carbonate 135 grams per liter, antimony trifluoride 26.4 grams per liter, stannous sulfate 32.6 grams per liter, gelatin 0.5 gram per liter, the current density being not less than 20 amperes per square foot.

Abrasive Wheel

U. S. Patent 2,462,741. *Elisha W. Hall.*

In a rotary abrading tool, the combination of a hub having two sets of lugs, the lugs of one set alternating

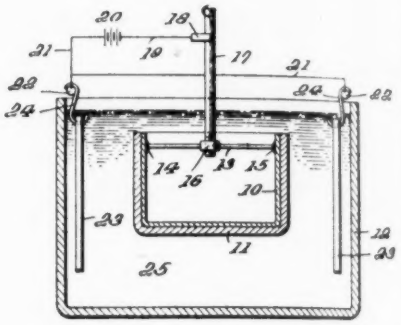


with the lugs of the other set, and the lugs of one set having free ends extending in a direction opposite to those of the other set, and a circumferential mass of abrading material having alternate openings receiving alternate lugs.

Copper Plating Cooking Utensils

U. S. Patent 2,465,608. *Angelo C. Scavullo.*

In the production of a culinary vessel having bottom and side wall portions with an inner stainless steel surface and a copper outer surface, the art which includes supporting a



partially formed vessel comprising a layer of mild steel and an inner surface layer of stainless steel for vertical axial rotation by means also providing electrical contact to the stainless steel surface by way of soldered joints, immersing the partially formed vessel in a copper plating bath, passing electro-plating current through said vessel by way of said soldered joints, and rotating the partially formed vessel by way of said supporting and contact soldered points while passing said electro-plating current and electrodepositing copper onto the exterior surface thereof to achieve said copper outer surface without electrodepositing on said inner stainless steel surface.

Conversion Coating for Magnesium Alloys

U. S. Patent 2,465,443. *Rene Gide.*

The method of treating magnesium and magnesium base alloy articles to increase their resistance to corrosion which comprises cleaning and degreasing the articles and imersing the articles in a boiling aqueous solution comprising primarily a sulphate and salt of a metal which is lower in the electromotive series than the metal to be protected, and potassium permanganate, the content of potassium permanganate in the solution being about 1 to 6 per cent, and the total content of the other salts aforesaid being about 0.1 to 1 per cent.

Engineering Information Useful In Designating Metallic Surface Treatments

Engineering Data Sheet

CADMIUM PLATING

A Comparison of Plating Thickness Specifications of Various Services, Societies, and Industrial Firms

AMERICAN SOCIETY FOR TESTING MATERIALS

Specification A165-40T

Plating thickness on significant surfaces—

Type NS	.0005″ minimum
Type OS	.0003″ "
Type TS	.00015″ "

Notes—

Significant surfaces on any part must be mutually agreed upon by vendor and purchaser.
Microscopic method used for checking thickness.

NAVY DEPARTMENT

Specification 46-P-1

Plating thickness on significant surfaces—

Parts not externally threaded	.0005″ min.
Externally threaded parts	.0002″ "

Heavier coatings may be specified on contract.

Notes—

Drop test used for checking (Ammonium nitrate-Hydrochloric acid reagent).
Bend test around a mandrel of same thickness as sheet also a part of this specification.

CHRYSLER CORPORATION

Product Specifications 182, 368, 754, 891

Plating thickness on significant surfaces—

Class A	.0005″ min.
Class B	.00015″ "

Notes—

Class A plating to withstand 100 hrs. Salt Spray Test. Used for direct outdoor exposure.
Class B plating to withstand 50 hrs. Salt Spray Test. Used for parts not directly exposed and non-ferrous parts.
Spring materials baked at 375°F for 3 hrs. to relieve hydrogen embrittlement.

PACKARD MOTOR CAR COMPANY

Specification 1408

Plating thickness on significant surfaces—

.0005″ min. for both interior and exterior use.
.00015″-.00035″ for spring temper parts.

Notes—

Spring tempered parts baked at 350-400°F for 1 hr. to relieve hydrogen embrittlement.

SOCIETY OF AUTOMOTIVE ENGINEERS

Specification AMS 2400F

Plating thickness on significant surfaces—

Non-threaded parts	.0003-.0005″ min.
Threaded parts	.0001″ min. at root of thread .0002″ min. on non-threaded areas

Notes—

Significant surfaces are those touched by a .750″ dia. ball.
Drop test used (Chromic acid-Sulfuric acid reagent).
.0003″ plating must withstand 200 hrs. Salt Spray Test.
.0001″ plating must withstand 100 hrs. Salt Spray Test.

AIR FORCE—NAVY DEPARTMENTS

Specification AN-P-61-2

Plating thickness on significant surfaces—

Non-threaded parts	.0003″ min.
Threaded areas	.0002″ "

Notes—

.0003″ plating must withstand 200 hrs. Salt Spray Test.
.0002″ plating must withstand 100 hrs. Salt Spray Test.
Drop test used for checking (Ammonium nitrate-Hydrochoric acid reagent).

FORD MOTOR COMPANY

Product Specification P-41

Plating thickness on significant surfaces—

Class A	.0005″ min.
Class B	.00035″ "
Class C	.00015″ "

Notes—

Class A plating to withstand 100 hrs. Salt Spray Test.
Class B plating to withstand 50 hrs. Salt Spray Test.
Class C plating to withstand 25 hrs. Salt Spray Test.
Spring temper parts baked at 400°F for 45 mins.
Case hardened parts baked at 350°F for 1 hr. minimum.

GENERAL MOTORS CORPORATION

Specification 4252-M

Plating thickness on significant surfaces—

Code 50	.0005″ min.
Code 20	.0002″ "
Code 15	.00015″ "
Code 10	.0001″ "

Notes—

Drop test used for checking (Chromic acid-Sulfuric acid reagent.
Parts harder than 302 Brinnell baked at 400°F for 4 hrs. or 300°F for 8 hrs.

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SILICATES IN METAL CLEANING

Reader correspondence and authors' reply.

[The original article in question appeared in the April issue of Metal Finishing. Dr. Meyer's letter, commenting on this article, was published in the May issue.—ED.]

Dear Editor:

On pages 110 and 111 of Metal Finishing for May, 1949, Dr. Walter R. Meyer has commented on an article appearing in the April issue by MacMullin and Ozar. In both the letter and the article reference is made to work reported by Dr. Fred Hazel and the writer. It appears that some further clarification is needed.

Dr. Meyer states his organization has "done a great deal of work on the formulation of alkaline cleaners and zinc base die castings," but gives no reference to any publication of such results nor does his letter contain any data. Therefore it is impossible to judge whether or not he tried the recommendations set forth in our article. Furthermore, we have no basis for judging why he prefers anodic to cathodic cleaning. Actually we described conditions for good cleaning, either anodically or cathodically, and would like to know whether these conditions were met in the tests to which Dr. Meyer refers.

Meyer states that we should have run plating tests following our cleaning tests and states that this is their practice. Here again we have no data whatever to go on so we can not tell what kind of plate he applied. We will assume, however, that he plated with copper and heated to 300° F. for an unspecified time since this is the method which is used when some organic coatings are applied to zinc castings. Whether this test is of any value in determining the effectiveness of cleaning before plating for other purposes, such as that to produce a chrome surface, is questionable. As a matter of fact, blistering tests were made and a very brief description of some of the results were given in a "Report on Sodium Silicate Cleaners" by A. B. Middleton which was published in the January, 1948, issue of "Die Castings" magazine. Hindsight is always better than foresight and we now wish that we had gone on and plated our samples so as to produce a chromium surface and exposed them to the weather. The writer has not seen any evidence that the blistering test is any indication of the protection gained by plating with copper, nickel and chromium. The cleaner the metal the greater seems to be the formation of a brittle zinc-copper alloy and if this layer contains gas, blistering on heating will occur. If Dr. Meyer has indications that there is a relationship between the amount of blistering on heating and the permanence of chromium plating, I certainly think he should publish it. Until we have such data I question the statement that "It is necessary that baking be done of the zinc base die castings," unless an organic finish is to be applied and baked on.

It would appear that Dr. Meyer in his tests has not followed the suggestions given in our article since he has had silicious material deposited on the surface of his zinc base die castings. Since he speaks of formulations we assume that the silicates were mixed with something else which might also affect the formation of deposits because our work showed that many constituents of cleaners caused deposits. We were able to use both metasilicate and sesquisilicate over a considerable concentration and pH range with no deposits.

We will agree that if a silicious deposit forms such a deposit is not readily soluble in most acid dips. We cannot agree with the statement that if sodium metasilicate is used without caustic that "films of a silicious material will deposit when the work is cleaned cathodically." In the first place metasilicate can be used within the ranges of 1-8% when the work is cathode at the recommended temperatures without any deposit forming. Outside of these ranges the deposit which forms appears to be zinc oxide which is removed by acid dips. The addition of a small amount of caustic would tend to produce the same results as sodium sesquisilicate which can be used over wider concentration and temperature ranges. However, the addition of too much caustic soda had an adverse effect. Dr. Meyer gives no indication of the proportion of caustic he recommends or whether other materials were present. Actually we gave concentration and temperature ranges for both cathodic and anodic cleaning.

We have done a considerable amount of work since the publications referred to and hope that we will be able to get the results in shape to publish. However, we hope that others also will publish any data they have so that results can be compared.

Yours very truly,
PHILADELPHIA QUARTZ COMPANY
WILLIAM STERICKER
Development Chemist

Dr. Meyer's Reply

Dear Editor:

I am pleased to have the opportunity of answering Dr. Stericker's letter of May 23rd. Needless to say a discussion of this type could be prolonged indefinitely because of the lack of specific information on the subject.

We are fundamentally interested in developing cleaning materials for zinc base die castings that must be electroplated, and we do not believe that we could properly evaluate the cleaning materials, therefore, without actually copper plating and baking the test panels. A great many manufacturers who plate zinc base die castings must also bake them to apply enamels or for other reasons. In addition, one is never certain that the castings will not be subjected to temperatures of 200-300°F. Therefore, if a cleaning procedure can be developed that will overcome blistering by baking, it would be preferable to have one which would not overcome this difficulty.

We have not done any work trying to correlate extent of blistering with resistance to weathering. We do not know whether the slow diffusion process that goes on at room temperature between copper and zinc has any influence on the resistance of the coating to weather or corrosive atmospheres. Although we have no information on the correlation between blistering on baking and weather resistance, I believe it would be better to try to develop cleaning procedures that would prevent blistering on baking because how does one know whether or not the casting will be exposed to high tem-

(Concluded on page 83)

New Methods, Materials and Equipment for the Metal Finishing Industries

Recent Developments

Buffing and Polishing Machines

Vanott Machine Corporation, Dept. MF, 218 Colgate Avenue, Buffalo 20, New York.

New buffing and polishing machines to provide greater movements for polishing large areas are announced by the above firm.

The machines are available in three

types—single, four and eight spindle units—with the head swivelled automatically by depressing a foot lever. Movements at right angles are accomplished by two hand wheels. Range of vertical adjustment has been increased and automatic oscillating movement up to six inches is available.

Chucks for holding the parts to be polished are custom built to meet individual industrial specifications. The Vanott engineering department welcomes consultation on specific polishing and buffing problems at no obligation.

Fume Suppression in Pickling Baths

Oakite Products, Inc., Dept. MF, 118 Thames St., New York 6, N. Y.

A new material, Oakite Composition No. 38, which produces a dense foam on acid pickling solutions and is claimed to effectively seal in evolved gases, has recently been introduced by this firm, manufacturers of specialized industrial cleaning and related materials.

Oakite Composition No. 38 is extremely stable in highly acidic solutions, the manufacturers report, and forms a dense foam blanket on nitric-hydrofluoric, hydrochloric, and sulphuric acid solutions to provide an efficient seal against the escape of acid fumes. Oakite Composition No. 38 is said to minimize the fuming of such bright dips as nitric-hydrofluoric acid on cast aluminum, nitric-sulphuric on brass and copper alloys at room temperature, and nitric-sulphuric-zinc oxide at 130° F. on copper alloys and brass. It is reported effectual for use in plants where acid fumes escaping into the air tend to rust exposed metal surfaces.

Readers desiring free additional data regarding this new material should write to the above address.

Water Dispersable Buffing Compounds

Globe Compound Co., Inc., Dept. MF, 276 Plank Road, Waterbury, Conn.

This firm has just announced the development of entirely new type of water dispersable buffing compositions. The products offered exhibit superior buffing performance, and complete rinsibility in hot water, it is claimed. The Globe buffing compositions are claimed to actually disintegrate in a few seconds, with dispersion of abrasives and emulsification of the binders. These compositions may also be removed by conventional degreasing procedures. The buffing characteristics of non-dispersable compounds are retained and even enhanced, according to the firm. The complete line of red and orange rouges, tripolis and aluminum oxides compounds are available.

Samples will be furnished by writing to the above address.

Cleaning Compound for Aluminum

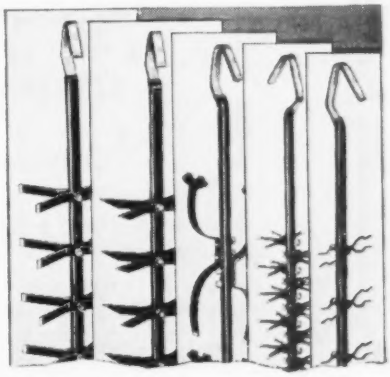
Northwest Chemical Co., Dept. MF, 9310 Roselawn Ave., Detroit 4, Mich.

A cleaning bath that is claimed to be effective on aluminum parts that are heavily coated with polishing compound, especially in recessed areas, is announced by the above firm. Complete removal of the soil without scrubbing is said to be accomplished by processing the work through this bath, composed of from 2-4 oz./gal. of Alkalume No. 1 plus 2% by volume of Liquid Stripper No. 2 for a period of from two-five minutes at 160°-190° F., (temperature depending upon the transfer time), followed by a thorcugh rinse of the free flowing or spray type. This is preliminary to the conventional painting, anodizing or plating cycle . . . May be used in manual or automatic equipment where cleaning is by immersion, according to the firm . . . Packaged in 400 lb. fiber drums for the Alkalume No. 1 and 500 lb. steel drums for the Liquid Stripper No. 2.

Five Racks for Most Plating Jobs

Belke Manufacturing Co., Dept. MF, 947 North Cicero Ave., Chicago 51, Ill.

Five rack models that are claimed to efficiently handle 90% of all plating jobs, including bright nickel and



chrome, is a new development of this firm.

Known as Belke Utility Racks, the five models have been developed to provide maximum racking flexibility and efficiency. A supply of Utility Racks on hand enables platers to start new work immediately and to estimate plating costs accurately, it is claimed. The racks are coated to withstand cleaning and plating cycles, and spring

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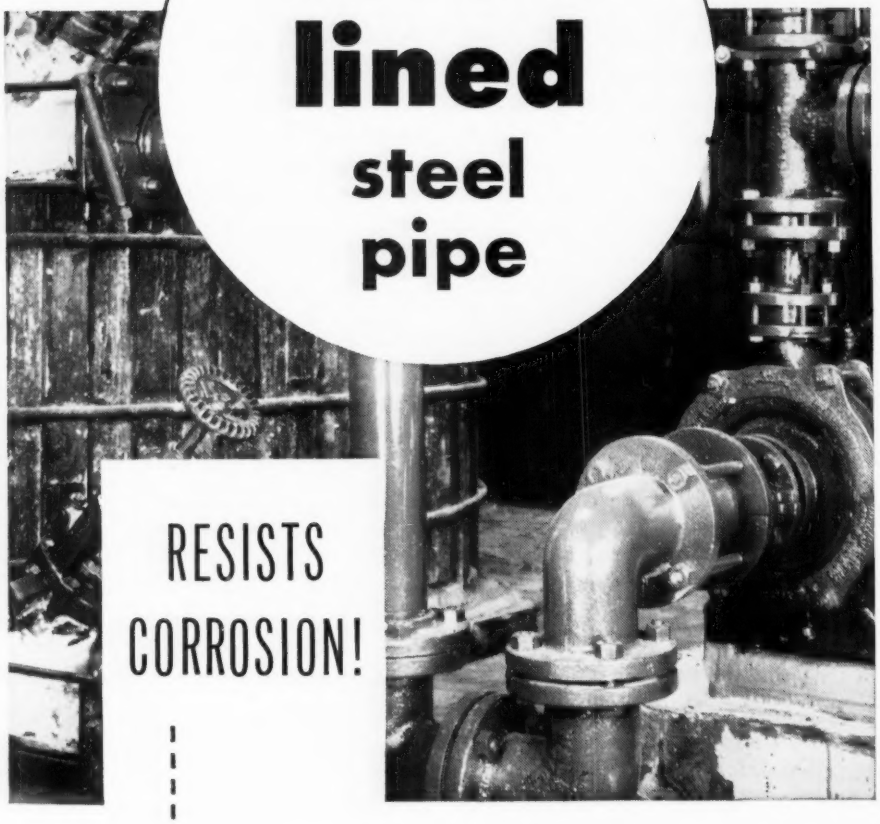
saran lined steel pipe



RESISTS CORROSION!

reduces shut-downs!
readily field-fabricated!
available immediately!
lower in cost!

Saran lined steel pipe is available in maximum lengths of 10 feet and in sizes from 1 to 4 inches inclusive.

Also available are saran lined plug valves, flanges, reducing flanges, flanged fittings, gaskets and fittings with union ends.

Write us today for further information concerning saran lined steel pipe and how it may solve your problem.

Manufactured by The Dow Chemical Company, distributed nationally by Saran Lined Pipe Company.

SARAN LINED PIPE COMPANY
702 Stephenson Building • Detroit, Michigan

Offices in: New York • Boston • Philadelphia • Pittsburgh • Chicago • Tulsa • Indianapolis • Houston San Francisco • Los Angeles • Portland • Cleveland Denver • Seattle • Toronto

DOW
CHEMICALS INDISPENSABLE TO INDUSTRY AND AGRICULTURE

pressure tips provide the positive electrical contact required for copper-nickel-chrome cycles.

The new removable tip assembly used on all models has a flexible cup-shaped collar of plastic that joins the plastic coating on the rack spine with a seep-proof seal, according to the firm.

Additional racking flexibility is afforded in that racks can also be furnished unassembled. Contact tips are located anywhere on the spine by drilling a ¼" hole. No tapping is necessary.

All models are available in 30" and 36" lengths assembled or unassembled. Descriptive literature furnished promptly on request.

Semi-Portable Dust Collectors

Hammond Machinery Builders, Dept. MF, 1639 Douglas Ave., Kalamazoo 54F, Mich.

This firm offers three newly re-designed Duskolectors. Each size unit covers a reasonably wide range of application, so that it can be used with any of a number of different grinding

machines, it is claimed. The proper size can be installed independent of other dust arrester systems, and installation requires only piping to grinder with flexible metal tubing or mteal pipe. Only one electrical connection is needed, and the starter may be connected to main grinder switch or operated by separate individual button. Motor and blower assembly are claimed to be easily accessible and can be raised by lifting a single plate which places the motor within easy reach.

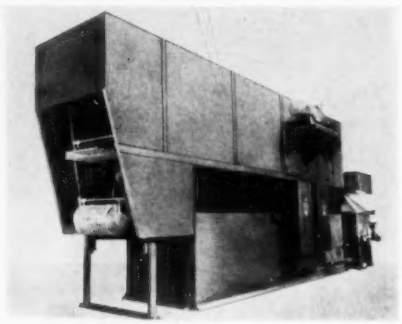
Dust-laden air is drawn from the grinder wheel hood through the air expansion chamber at the bottom of the cabinet, where the heavier parti-

cles drop immediately into the dust pan, due to decreased air velocity at this point and to special air-fin construction. The air is then drawn up through a set of three fiber glass filters which remove the finer particles. These filters are of the inexpensive "throw away" type and can be cleaned several times before they will need to be replaced, according to the firm. Since the air is drawn from the grinder and merely re-circulated in the room, no heat loss is involved. These units are specially suited for use in isolated tool rooms or departments where connection to a central exhaust system is too expensive or impractical, it is claimed. They offer the added advantage that they can be moved and installed in a few minutes, anywhere in the shop, wherever needed. The manufacturers offer three sizes, as follows: No. 30—¼ HP Motor, capacity 330 CFM. No. 40—½ HP Motor, capacity 700 CFM. No. 50—1 HP Motor, capacity 1000 CFM.

Tumbling Conveyor Degreasing Machine

Phillips Mfg. Co., Dept. MF, 3483 W. Touhey Ave., Chicago, Ill.

This machine is fully automatic, loading and unloading at the same end, and can carry either flat trays or tumbling baskets alternately (as per picture). The tumbling baskets are for small parts that would cup solvent.



By tumbling, great economy is introduced in the saving of solvent. The machine comes equipped with an automatic still and is so wired that dirty solvent is continually being pumped into the still and the reclaimed solvent is continually returned to the machine.

The conveyor system consists of two strands of roller chain connected at 2 ft. intervals by cross rods. A means for rotating the tumblers within the degreaser is provided. It is electrically heated by immersion type heating elements. The still is heated by strip

BECAUSE OF—

- Hard to Remove Buffing and Polishing Residues
- Drawing and Stamping Compounds
- Slushing Oils
- Stubborn Solid Dirt Particles
- Alkaline Damage

Try A PRECLEANING DIP IN Magnusol

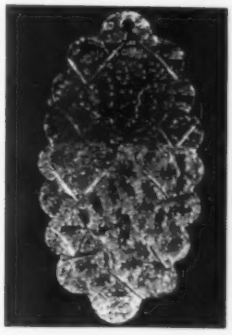
OFTEN a 30-second precleaning dip in Magnusol makes all the difference between a good and a bad plating job. All solid dirt and most stubborn residues will vanish in the water rinse after the dip.

If you're cleaning before plating, final alkaline cleaning to give you a chemically clean surface will be faster and better, when dirts that resist alkaline cleaning are first removed in Magnusol.

If you're cleaning for painting, lacquering and most other finishing operations, the Magnusol dip is usually all you need to get a satisfactory surface for your finish.

Magnusol precleaning is economical as well as simple. Work is dipped in or sprayed with the solution, then rinsed clean with a water spray. No heat is required.

Magnusol is supplied as a concentrate to be used with kerosene or safety solvent in the proportion of one part to six or eight parts of the diluent. It is safe for all metals, and is non-toxic and non-inflammable.



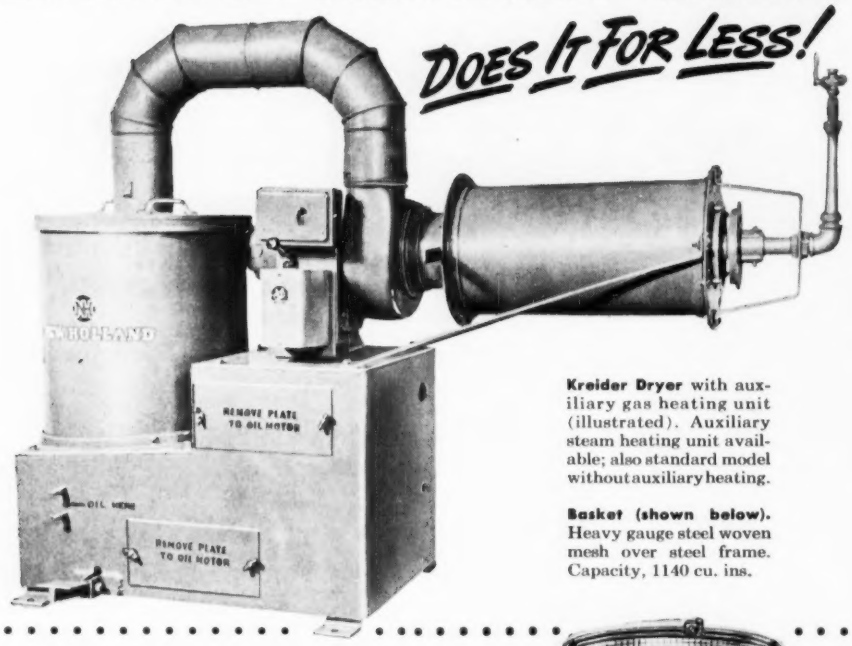
Ask us to arrange for a demonstration of what Magnusol can do on your work, *right in your own plant.*

Buffed brass plate, lower portion dipped in Magnusol solution and water rinsed. Note how thoroughly heavy dirt load has been removed from the rough background.

MAGNUS CHEMICAL COMPANY • 11 South Ave., Garwood, N. J.
IN CANADA—MAGNUS CHEMICALS, LTD., 4040 Rue Masson, Montreal 36, Que.
Service representatives in principal cities

DRIES SMALL PARTS *Faster–Better...*

DOES IT FOR LESS!



Kreider Dryer with auxiliary gas heating unit (illustrated). Auxiliary steam heating unit available; also standard model without auxiliary heating.

Basket (shown below). Heavy gauge steel woven mesh over steel frame. Capacity, 1140 cu. ins.

Spin-Dries* up to 50 pounds in less than 2 minutes

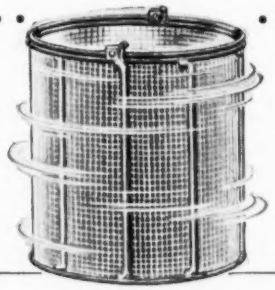
Simple design . . . careful engineering, sturdy construction assure trouble-free, low-cost maintenance operation. Operates at 625 r.p.m. on less than 1 h.p.

No scarring or marring . . . with Kreider Dryer. Centrifugal force holds parts immovable in basket . . . assures smooth, evenly dried surfaces, long-lasting luster, minimum "rejects".

One man runs it! Standard model Kreider Dryer occupies less than 6 sq. ft. floor space. One man tends—loads, unloads—keeps production moving, prevents expensive, time-wasting tie-ups.

See for yourself! Write Department M-79 today for illustrated 4-page folder . . . also addresses of installations near you.

New Holland Machine Co., New Holland, Pa.



***Only 2 simple steps required . . .**

(1) Operator places wire mesh basketful of small parts in Dryer . . . turns motor "ON."

(2) Operator turns motor "OFF" . . . presses foot brake . . . removes basket.

NEW HOLLAND *KREIDER* DRYER

heaters and has a distillation rate of 60 to 75 gallons per hour. Both still and machine are fully automatic, having low limit controls which shut off the heat and manual reset safety controls in boiling chambers to shut off heaters if boiling teperature of solvent rises to the danger point due to excessive contamination or low solvent level.

This machine has a capacity of approximately 2,000# to 4,000# per hour, depending upon the type of part being cleaned.

New Sisal Buffs

Joseph R. Davies & Associates, Dept. MF, 302 N. Halsted St., Chicago 6, Ill.

This firm has announced the development of a new type of buff made from sisal fibers. Outstanding features claimed for this type of material are resistance to burning on heavy production automatic machines, and long life. The buffs are supplied in even and fractional diameters, permitting the build-up of formed wheels for curved surfaces without the necessity of forming the contour of the wheel after it has been mounted on the machine. Many types of sewing are available in order to change the consistency of the buff, and soaking of the buff in oil or water may also be used to decrease the hardness, according to the firm. Elimination of grease wheel operations in buffing stainless steel, cold-rolled steel and hard aluminum are claimed to be possible by using these sisal buffs. Standard sections are 3/8" thick, as compared to the

SOFT CLOTH RETAINING DISCS
CENTER DISCS OF ABRASIVE FIBER MESH, EACH DISC RADIATING AT A DIFFERENT ANGLE
EVENLY SPACED INTERSTICES PROVIDE VENTILATION AND RETAIN CUTTING ROUGE

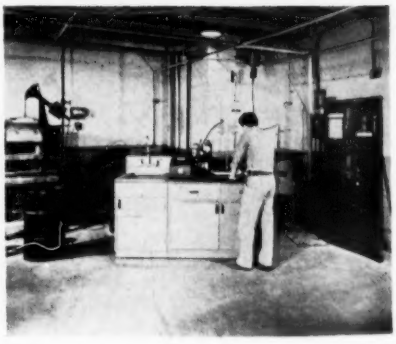
usual 1/4" thickness of other types of cloth buffs. Further information may be obtained by writing to the firm at the above address.

Prefabricated Test Benches

Fisher Scientific Co., Dept. MF, 714 Forbes St., Pittsburgh 19, Pa.

Test benches for use at test stations in metal producing and working industries plants can now be had in any length and in a variety of designs, by joining prefabricated steel units recently developed and now available from stock.

Eighteen different all-steel units are available, including drawers, cup-



boards, sinks, tables, storage cases, etc. They are designed to be joined easily one to another to form test benches either 30" or 36" high. Units are two, three, four or five feet in length and make use of the newly developed plastic-impregnated stone called "Kemrock" for bench working surfaces. "Kemrock" is tough, smooth, black and extremely resistant to ovens and chemically corrosive materials, it is claimed.

The new line, called "Unitized" test

benches, answers a need for heavy steel furniture upon which to run weighing, electrolytic, polarographic, colorimetric, or other tests at convenient in-the-plant areas.

An illustrated catalog giving full details, dimensions, and prices can be had from the manufacturer.

Relative Humidity Indicator Fan

Weston Electrical Instrument Corp., Dept. MF, 617 Frelinghuysen Avenue, Newark 5, N. J.

Accurate humidity readings can now be obtained quickly in factories, shops,

rooms and even small, confined spaces near, or in operating machinery, with a new motor-operated fan developed for attaching to any Weston Relative Humidity Indicator, it is claimed.

The small fan, powered by dry cells, will move air over the indicator's wick in sufficient volume to permit obtaining stable readings within 30 seconds. This makes possible complete analysis of humidity conditions, thus enabling the adjustment of the humidifiers and air-conditioning equipment for best results.

No calculations are required, as readings are immediately obtained on the instrument's simplified slide rule.

Weston Relative Humidity Indicators are now available with or without the auxiliary fan, or the auxiliary fan can be purchased separately. Write for complete information.

TODAY'S BEST BUY

for Setting Up POLISHING WHEELS AND BELTS

GRIPMASTER PATENTED POLISHING WHEEL CEMENT

LEADING PLANTS REPORT:

GRIPMASTER BOOSTS POLISHERS' PRODUCTION AN AVERAGE OF 47% MORE PIECES PER HEAD!

Now! **Longer Wheel Head Life!** Thanks to Gripmaster's special high-heat resisting ingredient!

Now! **Fewer Stops for Wheel Changes!** Gripmaster *locks in* grains of emery "vise tight!"

Now! **Inventories Simplified!** One grade grips *all* grains—300 to 20. No special sizer needed!

Now! **Better Finishes!** Greater flexibility gives more and finer "breaks" when wheel is "cracked!"

Now! **Goodbye to S. O.!** There's no Stockyards Odor in Gripmaster. It's clean, odor-free!

"First Choice of the World's Best Finishers"

YOURS FOR THE ASKING

GRIPMASTER DIVISION
NELSON CHEMICALS CORPORATION
12345 Schaefer Hwy, Detroit 27, Mich., U.S.A.

IN CANADA:
H. C. Nelson Chemicals, Ltd.
Windsor, Ontario

☐ Send us a generous FREE SAMPLE of Gripmaster.
☐ Send us data on how to boost polishing production.
☐ Have a representative call to demonstrate.

M.F. 749

COMPANY _____

ATTENTION _____

ADDRESS _____

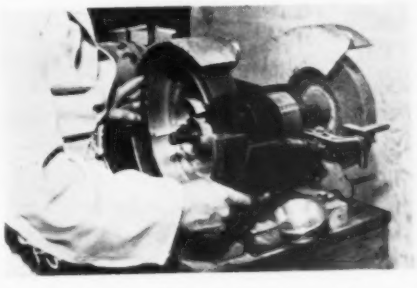
CITY _____ STATE _____

Strip Abrasives for Polishing

American Diamond Saw Co., Dept. MF, 519 N.W. Park Ave., Portland, Oregon.

The cost of polishing and grinding can be reduced through use of the new Cone-Loc Drum Sander and ordinary strips of abrasives, according to the above firm, as abrasives purchased in utility rolls often save as much as 75% over abrasives in "endless belt" form.

The new Cone-Loc drum sander is a balanced aluminum split drum, cushioned with rubber, the halves of the drum being locked into a solid drum by a cone type washer. Its light weight makes it highly adaptable for



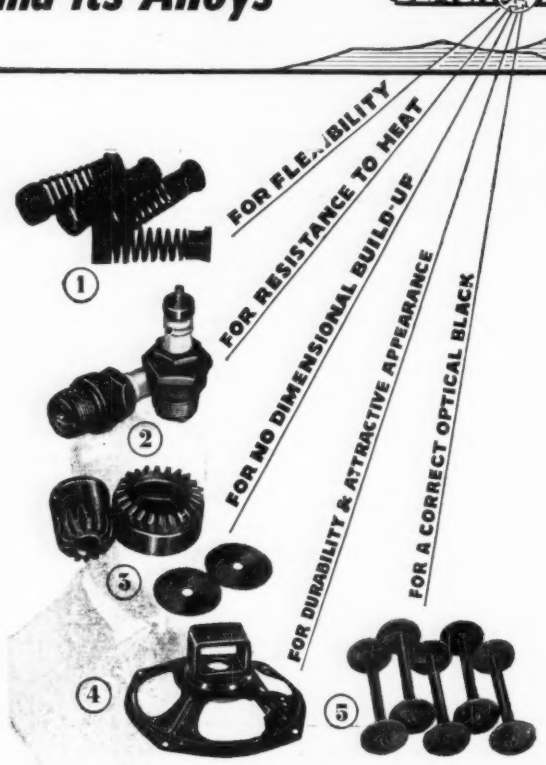
use with a flexible shaft as well as on a stationary arbor, it is claimed.

Standard width abrasives, available in roll form, are wrapped around the drum and secured into place by pins that recede out of the way when the cone washer is tightened down. Abrasive cloth in various grits can be quickly interchanged on the same

FINISHES FOR STEEL, IRON, ZINC, CADMIUM, COPPER

and its Alloys

BLACK MAGIC



1. BLACK MAGIC, a rich permanent black finish integral with the metal surface; does not chip, flake, or peel.
2. Resistant to heat and thermal shock. Spark Plugs, Stove and Machine parts.
3. No dimensional change. Gauges, Machine parts, Bearings.
4. Sales appeal and service life. Radio parts, Toys, Screws, Tools.
5. Optical black finish. Camera spools, internal parts for cameras, optical and similar instruments.

WRITE FOR "Black Book" of details on BLACK MAGIC. See the finish on your parts. Send samples for processing.

MITCHELL-BRADFORD CHEMICAL COMPANY
MODERN METAL FINISHES
2446C MAIN ST., STRATFORD, CONN.

BLACK-MAGIC OXIDE BLACKING SALTS
WITCH-DIP & WITCH-OIL FINAL FINISHES

SILCO *Glass-Base* PROTECTIVE COATING
HEAT TREATING SALTS. CLEANERS. ETC.

drum to accommodate rough or fine work.

The new sander is available rubber cushioned, in sizes from 6¼" to 12" diameter and various standard widths and bores. A 6¼" felt cushioned sander is also available.

Black Finish for Iron and Steel

Atomite Black Co., Dept. MF, 549 Washington Blvd., Chicago 6, Ill.

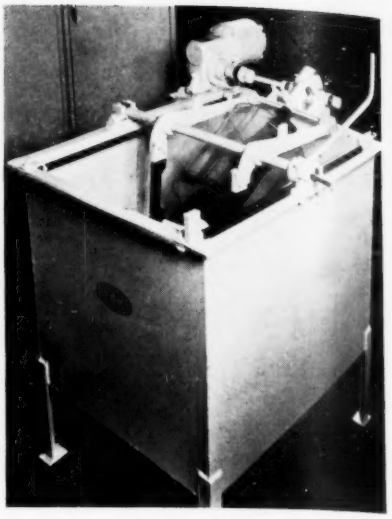
This firm announces its new Atomite blackening process for ferrous metals, which is claimed to produce a superior black color. The bath operates at approx. 295°F., salts being added to the bath to maintain the boiling point.

Besides its use as a final finish, either oiled or waxed, the treatment is claimed to be very effective as a paint base. No special equipment is required, as only simple cleaning and rinsing treatments are needed in conjunction with the blackening treatment. Further details may be obtained by writing to the firm at the above address.

Combination Barrel and Still Plating Machine

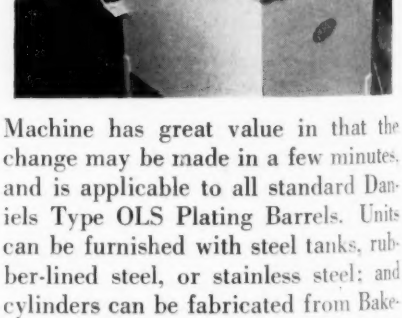
The Daniels Plating Barrel and Supply Company, Dept. MF, 129 Oliver St., Newark 5, N. J.

This firm announces the manufacture and sales of a new and versatile plating machine, which incorporates all the desirable features of the standard Daniels Type OLS Plating Barrel,



and yet may be used for still tank plating on a production basis. Pictured here is the Daniels double-duty plating machine. The unit is so designed that the standard cylinder and framework is completely removable and becomes adaptable for still tank plating by placing a rack with a cathode rod or, if desired, a double cathode rod and an anode rod over the tank. The still plating rack is so designed that when securely in position all electrical connections are fast, thus eliminating the the necessity of rewiring or moving bus bar. The unit is more versatile when double cathode rods are being used, for by the addition of cams to the drive shaft, the cathode rods may be agitated.

This double-purpose Daniels Plating



Machine has great value in that the change may be made in a few minutes, and is applicable to all standard Daniels Type OLS Plating Barrels. Units can be furnished with steel tanks, rubber-lined steel, or stainless steel; and cylinders can be fabricated from Bakelite, hard rubber, or boilable Lucite as pictured here.

Simplified Plating Rod Maintenance

M. E. Baker Co., Dept. MF, 25 Wheeler St., Cambridge 38, Mass.

Polyethylene sheeting, available in 6" wide rolls, is designed to eliminate

anode rod and anode hook maintenance.

"P.E." sheeting, wrapped around anode rods will protect rods and hooks against corrosion due to dragout or metal spray due to agitation, thus eliminating constant maintenance and insuring clean contact of anode hooks and anode rods. A recent test by a large plating plant showed a record of several months without maintenance whereas daily maintenance was necessary before using "P.E.," according to the above firm.

The sheeting is secured to the anode rod at intervals with any impervious tape or material.

All-Steel and All-Inconel Immersion Heaters

Edwin L. Wiegand Co., Dept. MF, 7500 Thomas Blvd., Pittsburgh 8, Pa.

A new series of all-stainless or all-Inconel Chromalox electric immersion heaters has just been announced by the above firm. These new screw-plug heaters can be used for heating a wide range of industrial chemicals, strong alkaline cleaners, extra-heavy degreasing solutions, oils of high sulphur content, and many other viscous and corrosive liquids, which do not attack stainless steel or Inconel.

These heaters are constructed of hair-pin shaped heavy duty Chromalox tubular elements welded into a solid screw-plug with 2-inch standard pipe thread and a heavy 3-inch hex section. The heating elements are die-pressed to a patented triangular cross-section to obtain high mechanical strength and a more dense refractory. This affords a better electrical insulation between the sheath and the resistor wire, and results in a maximum degree of heat transfer, it is claimed.

Heating elements, screw-plug, and welded joints are all made of the same alloy—type 347 18-8cb stabilized stainless steel, or nickel-chrome Inconel.

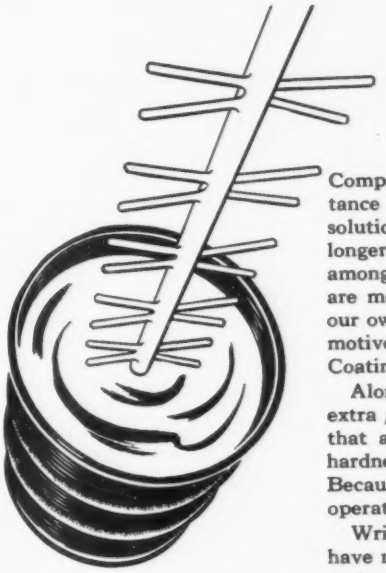
The heated length of the element ranges from 12 to 50 inches. The heaters are normally used in water-type solutions, and are derated for use in more viscous liquids.

Acid Resisting Material

Carboline Co., Dept. MF, 7603 Forsythe Blvd., St. Louis 5, Mo.

A resin which is claimed to be resistant to acids, alkalis, and solvents has been developed by this firm. The material is also said to be resistant to wear such as is encountered in flooring. The material comes as a liquid and powder that are mixed to a mortar and applied with a trowel. Vertical surfaces may be coated 1/16" thick with no sagging, it is claimed. When set the material is said to be waterproof and impervious to most corrosives and solvents except nitric acid and sulfuric acid over 45% in concentration. It is claimed to be useful for lining wood tanks and protecting concrete floors. Further information is available by writing to the above address.

TOUGHEST UNICHROME COATING YET!



Now, with COATING 218X, you'll spend even less to maintain racks

Compare this plastisol Unichrome coating for resistance to vapor degreaser, hot caustic and chromic acid solutions. You'll see why Coating 218X stands up longer, saves you money in *any* plating cycle. For among the chemicals used in plating cycles, those three are most destructive to rack coatings. Yet, results in our own laboratory, confirmed in that of a large automotive producer, prove they have *negligible effect* on Coating 218X!

Along with this remarkable chemical resistance goes extra *physical* toughness. Coating 218X has flexibility that absorbs hard knocks without chipping. Surface hardness resists accidental cutting and rough handling. Because it is free-rinsing, it permits continuous cycle operation with minimum dragout.

Write for new prices and data. Remember, if you have no baking facilities, you can still profit from the cost-cutting advantages of Coating 218X. Nearby applicators can serve you. We'll send you names.

UNICHROME

Trade Mark Reg. U.S. Pat. Off.

RACK COATINGS—Products of

UNITED CHROMIUM, INCORPORATED • 51 E. 42nd St., New York 17, N.Y.

Detroit 7, Mich. • Waterbury 90, Conn. • Chicago 4, Ill. • Dayton 2, Ohio • Los Angeles 13, Cal.

Rubber Coated Gloves

B. F. Goodrich Co., Dept. MF, Akron, Ohio.

A new rubber coated canvas glove curved to fit the hand, which the company claims gives greater finger dexterity than any other work glove, is announced by the above firm.

Coated with Neoprene, the glove gives maximum protection from dangerous acids, caustics, chemicals and other irritants, and is also resistant to greases and oils.

Made in three styles, knit wrist, and 12 and 14½ inch gauntlets, the gloves have one-piece back, which gives greater structural strength, with no

How to get Finer Finishes at Lower Costs

with GLOBE

Direct Motor Drive

TILTING TUMBLING BARRELS

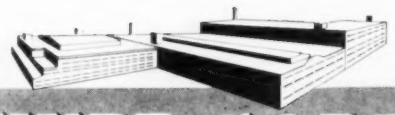
Available in Kiln-Dried Maple or Steel Shells

Process thousands of pieces at one time—faster, better and at lower cost—with Globe Precision Tumbling Barrels, dependable for 47 years. Globe's exclusive six-way work shifting motion cuts tumbling time and increases action. Speeds as low as 30 revolutions per minute assure finer finishes of non-ferrous metal parts. Motor is compactly mounted above the gear segment for space economy.

Free Experimental Service

Hupp's Experimental Engineering Laboratory can show you how to cut finishing costs. Just send samples of the parts to be processed along with a finished part. Write today! There's no charge or obligation.

Hupp Manufactures a Complete Line of Tumbling Barrels and De-Burring Machines.



HUPP CORPORATION

GLOBE STAMPING DIVISION

1250 WEST 76th STREET • CLEVELAND 2, OHIO

SERVING INDUSTRY SINCE 1902

seams to bind, irritate the hand, or split open.

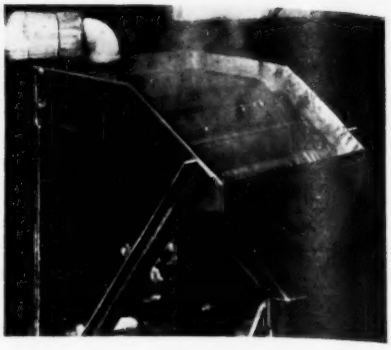
Curved fingers give greater knuckle freedom and "natural feel" the entire length of the fingers, enabling workers to operate with greater safety and efficiency, it is claimed.

The gloves are lined with flannel from finger tips to cuff ends for absorption of perspiration and elimination of sticky fingers and clammy hands. The gauntlet type has heavy duty scalloped cuffs designed to resist abrasion and tearing.

Removing Ferrous Particles from Processing Liquids

Bauer Bros. Co., Dept. MF, 1760 *Sheridan Ave., Springfield, Ohio.*

An interesting application of a chute-type magnetic separator is shown



in the accompanying photograph. The magnet is inserted in a sloping tray emptying into a funnel, the assembly being installed over the cleaning tank of an electro-plating system. From time to time, a pump is operated to circulate the cleaning solution across the magnet. Iron particles are thereby removed. Screens had been tried for the purpose, but those of fine enough texture to catch iron and steel dust quickly clogged and proved to be impractical, according to the manufacturer.

Unless ferrous particles are removed, they may adhere to the products after leaving the cleaning tank. Many of the particles become incorporated in the subsequent plated coating, causing roughness, and particles which washed off in the plating tanks contaminated the electrolyte.

The separator employed in this operation is a regular Bauer magnet which was given a water-proofing treatment. The manufacturer states that magnets can be treated to handle a large variety of liquids, thus making the separators applicable to the demetallization of oil, coolants, juices, and other fluids.

Literature describing this and other Bauer magnets is available on request.

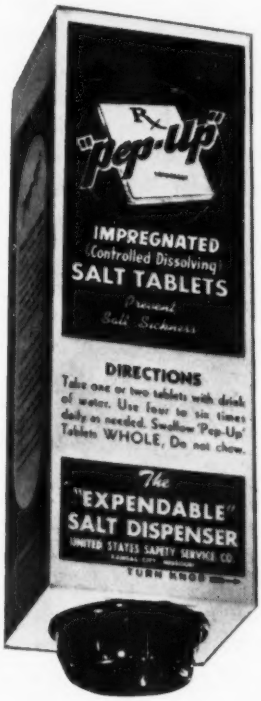
Improved Salt Tablets

United States Safety Service Company, Dept. MF, Kansas City, Missouri.

During World War II the U. S. Navy learned that a big percentage of their personnel could not take plain salt tablets or salted drinking water because it caused stomach distress and nausea. This presented quite a problem because it meant that thousands of men who seriously needed salt replacement could not get it by using plain

salt tablets. The Naval Research Institute at the National Naval Air Center, Bethesda, Maryland, after considerable research and work developed a new slow dissolving salt tablet which releases some salt immediately after taking, but not enough to cause stomach distress or nausea.

The formula developed is now being used to produce Pep-Up Impregnated Salt Tablets. These tablets are subjected to an exclusive patented process which forms a complete coating around each grain of salt in each



tablet. The manufacturer claims that these tablets will also withstand the high temperatures and humidity of tropical climates, as well as the friction and impacts of handling and will not absorb moisture from the air and clog dispensers.

Another unique feature is the way the manufacturer is packaging these salt tablets for the user. The package is the dispenser. A sturdy container of inexpensive material is used which has a built-in dispensing unit and the entire container can be attached to the wall. Factory sealing insures sanitation, and when the container is empty it is discarded and replaced with a new full container.

Automatic Grease Lubricator for Conveyors

J. N. Fauver Co., Dept. MF, 49 W. Hancock, Detroit 1, Mich.

A new, simplified self-contained grease lubricator for conveyors, of the type that requires no external power for its operation and is driven by contact with the trolley wheels, is announced by this firm. It includes a transparent plastic reservoir which performs dual duty as a liquid level guage; a quick release lever for taking the lubricator out of service, and the option of spring follower or air pressure on the reservoir for forcing the lubricant into the pumping units.

As a trolley wheel approaches the lubricator the hub engages the sleeve of one of the five pumping units which is thus automatically brought into contact with the wheel bearing. Continued rotation of the lubricator forces the pumping unit inward, delivering a measured quantity of lubricant through the fitting to the wheel bearing. Thus one trolley wheel is greased and a cam located in the pump housing snaps the next pumping unit into position to contact the next wheel as it comes along. This process is continuous, as long as the conveyor is in motion.

Chemically Resistant Gloves

The Milburn Company, Dept. MF, 3246 E. Woodbridge St., Detroit 7, Mich.

A new coated cotton work glove which claims to have several advantages over synthetic rubber or other plastic gloves in its chemical resistance properties, has just been put on the market by the above firm.

Plyglov, the trade name of this new

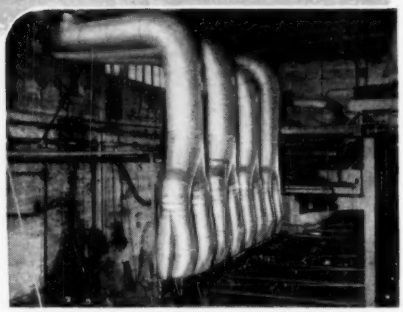
Problem
To cut operating costs with buffs that hold compounds longer.
Solution
USE
WILLIAMSVILLE BUFF DIVISION EST 1893 A1 DANIELSON CONNECTICUT
BUFFS
Result
Lower buffing costs with "Duplex" 34-ply — has pockets for holding compounds.
WILLIAMSVILLE BUFF DIVISION
The Bullard Clark Company
DANIELSON, CONNECTICUT

Ohio FUME AND DUST REMOVAL SYSTEMS
TANGIBLE DOLLAR SAVERS

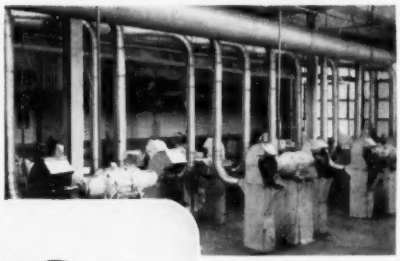
● Records on hundreds of Ohio Blow Pipe jobs prove without question that production output materially increased and employee absence and complaints radically decreased after the installation of an Ohio System for ventilation of fumes from plating and rinse tanks and dust collection from grinding, polishing and buffing.

Ohio Systems are not standard fit-all systems. They are designed and engineered to meet your individual requirements. Ohio engineers, thoroughly experienced in their field, make a careful, exacting survey of your plant and an analysis of conditions and then plan the system that will meet most efficiently your special needs and conditions.

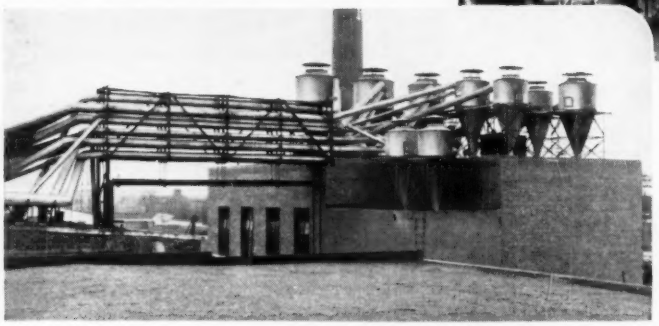
Call, write or phone today and let Ohio engineers make a survey and give you, without obligation, an estimate.



Fumes Removal Installation in Plating Room



Dust Collecting System for Buffing Machines



Cyclone Type Dust Collectors

Ohio BLOW PIPE CO.
ENGINEERS AND MANUFACTURERS
1725 DOAN AVENUE • CLEVELAND 12, OHIO

glove, will not crack or peel, does not become slippery when immersed in oil, water or solvents, and is water, acid, caustic and petroleum solvents proof, according to this firm. The manufacturer claims that, on comparable jobs, this new glove will outwear 10 pairs of cotton or 4 pairs of synthetic rubber gloves. They are available in four different styles to meet various working conditions.

Carboy Tilter With Ratchet Control

General Scientific Equipment Co., Dept. MF, 2700 W. Huntingdon St., Phila. 32, Pa.

The new G-S Safety Carboy Tilter

with pouring spout provides a safe, fast and convenient method of draining acids and other liquids from carboys, it is claimed. It fits carboys of any size. The cradle and supporting base are made of structural steel, and all members are riveted or welded to insure a strong, durable unit.

The locking device permits the carboy to be positively held at any angle for pouring so that the whole operation can be done by one man. The safety air-vent pouring spout insures an even flow of acid without spurts or splashes, it is claimed. This is made of acid-resistant rubber and plastic tubing for long wear. Flow capacity is 5 gallons per minute. The long handle operates the tilter easily and permits the operator to remain at a safe distance from the acid.

The tilter can be safely left in a position just above the flow of the acid so that it is not necessary to return the carboy each time all the way to a pouring position.

Lightweight Protective Masks

Parker Safety Equip. Co., Dept. MF, 785 Lyons Ave., Irvington 11, N. J.

The Parker protective masks consist of a sanitary, non-inflamable plastic face-shield which conforms to the contours of the face and is held securely in place by replaceable elastic bands. Attached to the shield is a laminated cotton gauze refill pad, which permits free and easy breathing while it excludes particles of dust. They are useful for many kinds of nuisance dusts and paint spray mists; however, they are not to be used when fine silica dust, lead, arsenic, and other toxic dusts are present.

The entire mask and refill combined weigh less than ½ ounce, and are very reasonably priced.

Manufacturers' Literature

Automatic Polishing and Buffing Machines

Hammond Machinery Builders, Inc., Dept. MF, 1639 Douglas Ave., Kalamazoo, Mich.

To be used in conjunction with Hammond polishing and buffing lathes, or any similar type, Hammond Machinery Builders announce a new line of 10 Junior Automatic machines, described in a recent bulletin which has just come off the press. The machines are said to increase production as much as seven times over hand polishing operations in come cases and to greatly reduce operator fatigue, resulting in a lower cost per piece due to

increased production. The bulletin describes models that have simple rotating spindles and also other models that have a stroke adjustment from 0" to 12" to be used when the work is longer than the width of the abrasive or polishing wheel. Models also include two spindle, manual indexing and four spindle, power indexing machines for high-production polishing of small parts.

Mounting and Polishing Apparatus for Metallographic Work

Precision Scientific Company, Dept. MF, 3737 W. Cortland St., Chicago 47, Ill.

A new 32-page, 2-color Catalog 860-NR has just been printed by this firm illustrating and describing a complete line of laboratory apparatus and accessories for the preparation of metallographic specimens. Included are the "Polmatic" automatic polisher, the "Subcut" submerged specimen cutter, the "Aeromount" semi-automatic specimen mounting press, hand-operated mounting presses and polishers, with many accessories. Copies of Catalog 860NR will be mailed on request.

Fluxes for Hot Dip Galvanizing and Tinning

The Hanson-Van Winkle-Munning Company, Dept. MF, Matawan, New Jersey.

This firm has issued a new Bulletin, F-100, entitled "Why And How to Use H-VW-M Fluxes for Hot Dip Galvanizing and Hot Tinning."

It is a technical Instruction Manual, and gives the details for the use of H-VW-M No. 20 Fluxes for hot dip galvanizing and the H-VW-M Fas-Tin Flux for hot tinning. It reviews the techniques involved, describing and illustrating the pre-galvanizing cycle, giving a work flow sheet, operation by operation, for hot galvanizing from the first alkali cleaner, through pickling, rinses, fluxing and galvanizing. In hot tinning, the Bulletin describes the pre-tinning cycle and the use of Fas-Tin fluxes as a wash or a flux blanket.

The operator of a hot tinning or galvanizing plant will find this Bulletin of great technical assistance in his operations. Copies are available at no cost.

SHOW A NEAT FIGURE

IN SAVINGS ON

SOLVENT CONSUMPTION

BLAKESLEE SOLVENT VAPOR DEGREASERS

Blakeslee Solvent Vapor Degreasers are engineered to give 100% oil-free jobs with *lowest solvent consumption*. YES, through patented construction and operational features, they actually USE LESS SOLVENT.

They're time-saving too. Metal parts are rendered chemically clean and dry in a few seconds, eliminating tie-ups and rejects in subsequent finishing operations.

Get the benefits of Blakeslee experience and superior performance in the Solvent Vapor Degreaser—engineered for you.

You add less solvent daily to Blakeslee Degreasers

BLACOSOLV DEGREASERS AND SOLVENT

NIAGARA METAL PARTS WASHERS

G. S. BLAKESLEE & CO.

G. S. BLAKESLEE CO., CHICAGO 50, ILLINOIS
NEW YORK, N. Y. TORONTO, ONT.

Corrosion Resisting High Silicon Irons

The Duriron Company, Inc., Dept. MF, 17 East 42nd Street, New York 17, N. Y.

The data collected on Duriron and Durichlor in the last ten to fifteen years has been collated and published as Bulletin 113.

High silicon iron, an alloy containing 14½% silicon, was first produced in this country in 1912 under the trade name "Duriron." It became popular immediately because of its remarkable corrosion resistance. In 1923, a modified analysis with increased resistance to hydrochloric acid was introduced under the trade name "Durichlor."

Even though the extraordinary development of the Chemical Process Industries has led to the production of many corrosive resisting alloys of more versatile physical and machining characteristics, more Duriron and Durichlor is used today than ever before because of their unexcelled corrosion resistance and relatively low price, it is claimed.

A copy of this new bulletin can be had by writing to the above address.

Rubber Lined Exhaust Equipment

Heil Process Equipment Corp., Dept. MF, Cleveland, Ohio.

A new Bulletin, the "Heiline," has just been published by the above firm, which illustrates how rubber-lined exhaust ducts are being used to handle highly corrosive chemical fumes in such places as steel mill pickling, where a mixture of nitric acid and

NO SHUT DOWN

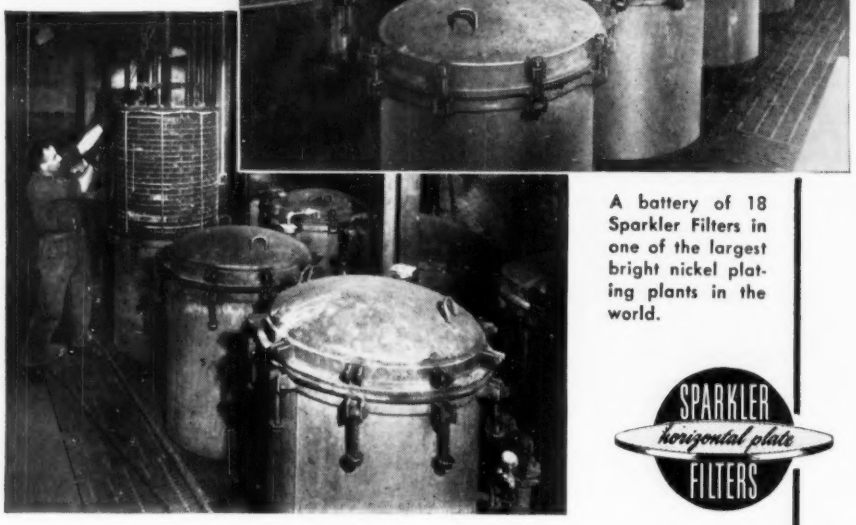
to carbon treat solution with . . .

SPARKLER *horizontal plate* FILTERS

Only a few minutes are required to lift out the horizontal plate assembly in a Sparkler Filter and drop in a clean set of filter plates and production is under way without appreciable interruption.

Tanks are given a carbon treatment without shutting down production in the battery installation shown here. One or two filters are cut out of the line, drained, cleaned and dressed with clean filter papers. The proper amount of carbon is mixed with water in a stand-by tank and recirculated through the filters thus depositing the carbon on the plates in a cake of uniform thickness and density. The solution requiring a carbon treatment is then circulated through the carbon beds giving the plating solution the carbon treatment without contaminating the tank or stopping plating operations.

Sparkler Horizontal Plate filters give absolutely sharp filtration at all stages of the cycle.



A battery of 18 Sparkler Filters in one of the largest bright nickel plating plants in the world.

SPARKLER *horizontal plate* FILTERS

SPARKLER MANUFACTURING CO., MUNDELEIN, ILLINOIS

hydrofluoric acids is used in pickling stainless steels. The bulletin also describes the various other acid resistant materials marketed by the firm for painting or covering tanks, etc., for handling corrosive solutions and gases. Copies are available on request to the above address.

Deburring and Finishing Equipment

Almco Div., Queen Stove Works, Dept. MF, Albert Lea, Minnesota.

A bulletin just issued by this firm describes their line of Supersheen deburring machines and materials for barrel finishing operations. In addition to their various tumbling machines, which range in size from 8" wide by 16" dia. to 60" by 30" diameter, this firm also markets three different types of tumbling compounds in a wide range of sizes. Auxiliary equipment, such as hoisting units, storage hoppers for compound, portable screening units, etc., are also illustrated and described. The firm also maintains a number of Engineering Clinics throughout the country to aid potential users in evaluating the merits of their equipment and processes. Free copies of the Bulletin are available on request to the above address.

Buffs and Polishing Wheels

Dearborn Industrial Mfg. Co., Dept. MF, 5049 Ogden Ave., Cicero 50, Ill.

A new bulletin just issued by this firm illustrates their line of buffs and polishing wheels for all metal finishing purposes. Included are bias-types, folded, full disc buffs, contact wheels, sheep skin wheels, jewelers buffs, and many others. Buffs are available in all standard or special sewings. Copies of the bulletin are available at no charge.

Illustrated Book Features Modern Coated Abrasives Service

Carborundum Co., Dept. MF, P.O. Box 337, Niagara Falls, N. Y.

To mark completion of its modern factory for the development and manufacture of coated abrasive products, The Carborundum Co. has published a 32-page, two-color book presenting the outstanding features of its new service, research and production facilities at Wheatfield, New York.

This book is illustrated with dry-brush drawings and describes the closely controlled, scientific methods employed at Wheatfield which assure production of quality abrasives. In addition, it outlines the importance to industry of these abrasive products for production of more and better goods, at lower cost.

All phases of operations in the new Wheatfield plant, embracing more than 12 acres of floor space, are covered in this book, from the receiving platforms where raw materials are delivered by rail and truck to the shipping room where consignments of finished products are sent on their way to district warehouses, distributors, consumers.

It shows the laboratories, where research men develop new and improved products, and where production engineers check manufactures for maintenance of product quality. It contains pictures of storage facilities for raw materials, semi-finished stocks and completely packaged finished products.

This book takes readers on a conducted tour of the new Wheatfield

plant. One can see the gigantic making machine which applies the glue or resin adhesive, coats abrasive grain evenly on backings of paper, cloth, fiber or combinations of these materials, dries and cures ten miles of material simultaneously. Manufacturing steps for converting huge "jumbo rolls" into discs, sheets, rolls, belts and special shapes are also illustrated.

Thus, the company has opened the doors of its new Coated Products Div. plant to industry so all may see how carefully the coated products by Carborundum are manufactured.

Pertinent information on the Demonstration and Experimental Grinding Laboratories, not only at Wheatfield, but also in the New York and Chicago Service Centers is given in this book. These grinding laboratories are conveniently located so customers may get help from the company's abrasive engineers in finding the best machines, methods, and abrasive products for grinding, finishing and polishing operations.

Copies of "The Finest in Coated Products . . . CARBORUNDUM" will be mailed on written request.

New Catalog of Russian Translations Available

The release of a new catalog listing translations of 91 Russian scientific papers has been announced by *Research Information Service, 509 Fifth Ave., New York 17, N. Y.*, translators of foreign technical data.

The fields of science and technology covered by the translations offered in Catalog No. 34 "Supplementary List of Translations of Russian Technical and Scientific Articles Published during the First Quarter of 1949" range from Aerodynamics to Physiology and include Biophysics, Ceramics and Glass, Chemical Warfare, Inorganic Chemistry, Organic Chemistry, Physical Chemistry, Crystallography, Drugs and Insecticides, Electron-Optics, Geology and Geophysics, Metals, Metallurgy, Mineralogy, Oceanography and Physics.

Copies of catalogs are available, free of charge.

SILICATES IN METAL CLEANING

(*Concluded from page 70*)

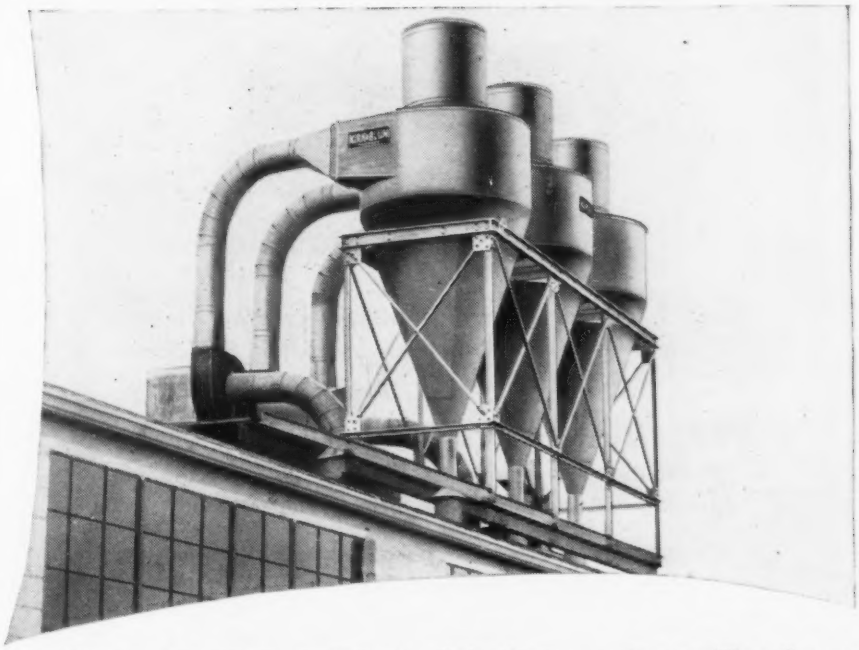
peratures? They certainly will have poor weather resistance if they have developed blisters because of exposure to temperatures ranging from 200 to 300°F.

In regard to deposition of silicious materials from cleaners containing silicates, increasing the caustic soda content will tend to overcome this difficulty and usually concentrations of caustic soda of the order of 1 oz./gal. or greater will retard the deposition of silicious films. However, in research or development work these silicious films may not have been noticed because, in many cases, they do not form in the cleaner until the cleaning material has had a chance to age near the boiling point for from 24 to 48 hours. It is possible to make up silicate-containing cleaners that will give absolutely no film during the first hour or second hour's use but a day later a considerable film will deposit on the work. It can not be removed by acids other than hydrofluoric acid.

One naturally wonders why there should be any significant difference between the results of cleaning zinc base die-castings anodically versus cathodically. Actually, no good explanation for the differences has been proposed and there may be a difference in results obtained depending upon the cleaning formulations used. Tests made with cleaning formulations containing complex phosphates and surface active materials that do not precipitate with zinc indicated, in every case, that anodic cleaning was preferable to cathodic cleaning, whereas, with cleaning materials containing silicates, we could find no appreciable difference between anodic versus cathodic cleaning. However, the results

This 3 section dust control system PROVIDES 3 DISTINCT ADVANTAGES

1. Economical night shift operation
2. Higher collecting efficiency
3. Flexibility



In providing a dust control system at the Nameplate & Monogram Company, Spencerville, Ohio, KIRK & BLUM Engineers designed a 3-system arrangement to accommodate special conditions within this particular plant. The results obtained in actual operation suggest that similar systems would be advantageous in many plants.

Dust control for 36 buffing and polishing machines was divided between the three systems. One of the systems serves the machines used on the night shift alone . . . thus avoiding the excessive cost of operating the complete system. In addition, multiple collectors provide higher collecting efficiency . . . the relocation of one line would not curtail the operation of the other two. THE KIRK & BLUM MFG. COMPANY, 2859 SPRING GROVE AVE., CINCINNATI 25, OHIO.

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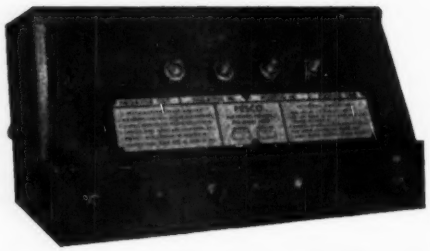

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obtained with the cleaning mixtures containing phosphates were better over-all than with mixtures containing phosphates plus silicates or silicates plus caustic soda. Our results were based on the extent of blistering of the zinc base die castings that had been copper plated and baked at 300° F. A possible explanation for better results obtained with anodic cleaning is that the zinc alloy surface may have the more active components dissolved preferentially from the surface, resulting in lowering of the local cell potentials on the surface. It is known that zinc base die castings contain aggregate varying considerably in electrochemical activity. (See the work of J. V. Petrocelli and A. Phillips, "Transactions of the Electrochemical Society," Volume 85, 1944—page 257 entitled "The Reactivity of Aluminum, Zinc and a Zinc Base Die Casting Alloy with Various Electrolytes"). It has been suggested that one reason for poor results obtained by cathodic cleaning is due to the hydrogen gas, either atomic or molecular, that is discharged at the cathode during cleaning. In view of the low solubility of hydrogen in zinc alloys (other than in actual pores or holes) I doubt whether hydrogen is a significant factor in causing poor adhesion or in contributing to increased rate of diffusion between copper and zinc.

We are pleased to learn that Dr. Stericker and his co-workers plan to continue this work and will attempt to obtain correlations between blistering, weathering and cleaning cycles.

Very truly yours,
Ethone, Inc.,
Walter R. Meyer.
President.

Dear Editor:

We note in the May 1949 issue of "Metal Finishing" a letter from Walter R. Meyer referring to our article, "Sodium Silicates in Metal Cleaning," and appreciate his comments.

We recognize that anodic cleaning is more popular than cathodic cleaning for zinc-base die castings, and indicated that both could be used under proper conditions.

He recommends baking the plated castings at 300°F. to observe the development or absence of blisters and we agree that this is a good method of testing the adherence of the plate.

He refers to tests performed in his

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DISCARDED WITH THE ARCHITECTURE

laboratory in which zinc-base die castings cleaned with formulations containing sodium metasilicate and plated developed blisters after baking. We are somewhat at a loss to interpret these results since the conditions of cleaning and plating were not given. We have observed zinc-base die castings being cleaned with silicated cleaners on a full scale production basis and successfully plated as indicated by examination for blisters after bake tests.

It is well known that poorly adherent plate can result from poor cleaning, inadequate rinsing, improper acid dipping or faulty plating—and the whole process must be considered before assigning the fault to any one step.

We would like to emphasize the importance of strength of acid dip in preparation for plating and possibly Dr. Meyer would have had better success in his tests had he varied this sufficiently. We have observed a non-silicated anodic electrocleaner that was working satisfactorily develop blisters after the strength of the sulfuric acid dip was increased from ¼-½% to ¾%. These bake test blisters were solely a function of the acid dip since other conditions were not changed and no silicate was present in the cleaner. On the other hand, we have observed a silicated anodic electrocleaner working satisfactorily with an acid dip of ¾-1%, but blisters developed in the bake test when the strength of acid was reduced to ¼-½%.

Concentration is also important and we have observed a silicated anodic electrocleaner work satisfactorily at 6 oz./gal., but blisters developed in the bake test when the concentration was reduced to 4 oz./gal.

Therefore, it is important that all factors be considered, and silicated cleaners can be employed in cleaning zinc base die castings when the proper conditions are used.

Smith and Karle, by their electron diffraction technique, found only oxides of iron on steel cleaned anodically in sodium metasilicate solution. These oxides would be readily soluble in acid. We would expect similar results on zinc.

After stating that anodic cleaning is greatly preferred for zinc base die castings, Dr. Meyer outlined a set of conditions for cathodic cleaning which gave a deposit on the work. Obviously

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Magnus Aja-Dip Cleaning Machines Offer You Better Cleaning, Greater Flexibility and Speed — Speed — Speed!

Because they are so fast in their cleaning action, they are ready for another load when ordinary machines are just starting to clean. When they are used with the right Magnus Cleaner, they give you a much better cleaning job than still tanks, spray-type machines or any other cleaning method.

The reason is their unique operating principle, through which the work is moved up and down IN the cleaning solution many times a minute. This dynamic mechanical cleaning action supplements the work of the solution.

Proof?

STEEL PARTS — toys and tools, replacing vapor degreasing. Output ten times that of former method at one-half the cost.

SURGICAL INSTRUMENTS — replacing still tank soak in solvent plus hand brushing. Output many times that of former method. Over-all costs reduced 25%. Rejects on plating operation virtually eliminated. Workers freed for productive work.

AIRPLANE PARTS — propeller hub and governor assemblies. Former method, still tank soak and hand work. Output tripled. Costs reduced by 55%, while damage to delicate parts has been eliminated.

MAGNETOS — two complete magnetos an hour could be cleaned by former method. With Aja-Dip, *thirty* better cleaned units an hour are handled. One man and the Aja-Dip produce what four men did by hand methods.

There's an Aja-Dip Machine to meet your capacity needs. INVESTIGATE

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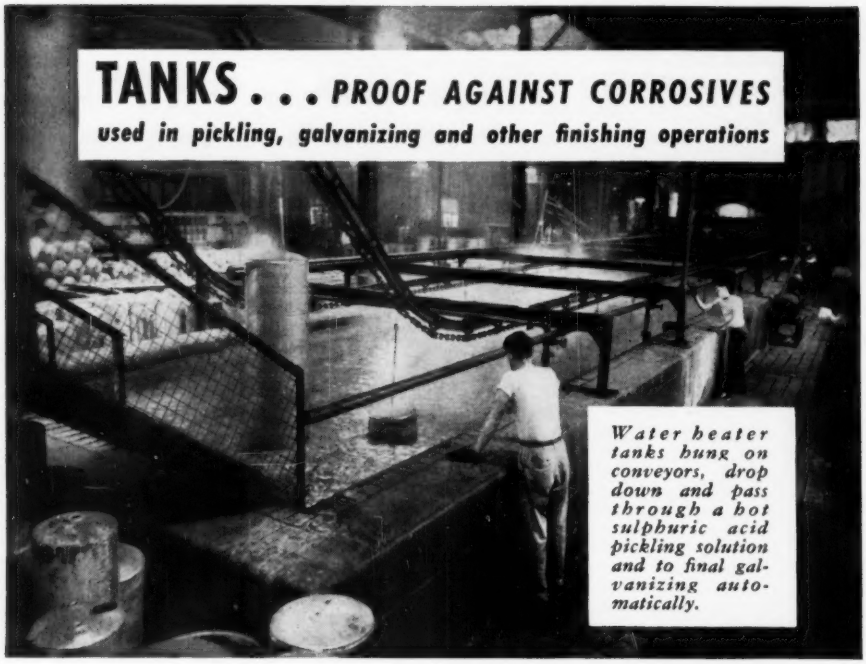
CLEANERS • EQUIPMENT • METHODS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used in pickling, galvanizing and other finishing operations
Water heater tanks hung on conveyors, drop down and pass through a hot sulphuric acid pickling solution and to final galvanizing automatically.

Photograph courtesy Rheem Manufacturing Co.

Atlas construction materials applied to a reinforced concrete shell consist of Atlastiseal impervious triple membrane lining. 8" Dual Construction acid brick sheathing using Tegul Vitrobond* and Korex* (exposed joints) acid proof cements were used in this installation.

ATLAS SERVICE includes design, material recommendations to meet specific operating conditions in all types of chemical tanks, acid and alkali-proof floors, sewers, stacks and fume ducts: and when desired, EXPERIENCED SUPERVISION furnished for your construction.

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these are not the optimum conditions. Better results would have been secured at higher pH, in the presence of caustic and with the zinc base die castings as the anode.

We heartily concur that care must be used in the formulation of cleaners and stress the point that the cleaners should be used properly and in conjunction with a suitable acid dip. We also believe "Metal Finishing" would like to hear from readers who have used silicate cleaners successfully prior to plating.

Our article was intended to emphasize the widespread use of silicates in the field of metal cleaning in general, and we are pleased to note that Dr. Meyer recognizes the enhanced detergency conferred upon alkaline cleaners by silicates, metasilicate in particular.

Very truly yours,
CLINTON W. MAC MULLEN
CLARENCE G. OZAR
Cowles Chemical Company.

LETTER TO THE EDITOR

Spotting-Out of Spot Welded Assemblies

Dear Editor:

In answer to C.A.T.'s question in the May issue of Metal Finishing, the best method of overcoming his problem, if it is impossible to re-design the parts, it to flash copper the individual parts prior to spot welding.

If the article is then spot welded after the flash coppering operation, and then finally plated bright copper, well rinsed cold and hot, your correspondent should have no trouble.

Yours very truly,
C. A. Velarde, *Works Chemist.*
Automatic Telephone & Electric Co., Ltd., Liverpool, England.

Business Items

Carter Elected President of Oakite

At the recent annual meeting of the stockholders and employees of *Oakite*

John A. Carter

Products, Inc., New York, manufacturers of industrial cleaning and allied materials, announcement was made by the Board of Directors of the election of *John A. Carter* as President of the Company. The new chief executive has been associated with the Oakite organization for 34 years, serving in recent years as Assistant to the President and, since December 1947, as General Manager of the Company.

D. C. Ball, founder and President of Oakite, and long a pioneer in the development of specialized cleaning materials for industry, was elected to the office of Chairman of the Board. Also announced at the meeting was the election of *David S. Ball*, former Vice President, to the newly created office of First Vice President, as well as the re-election of *H. Liggett Gray* as Vice President, *James Beckett* as Treasurer, and *David A. Hearn* as Secretary.

As President of the Oakite organization, Mr. Carter will direct activities of the 725 employees who make up the Company's producing, operating

and selling staff. Of this number, nearly 200 are members of a nation-wide sales and technical advisory service organization, ready to provide skilled in-plant assistance on cleaning and related problems wherever the occasion demands. "With the Company now at the greatest strength in its history," Mr. Carter states, "we plan to continue our expansion program so that we may be able to provide even greater service in the constantly broadening field of production and maintenance cleaning in the numerous industries where Oakite products have so many economical applications."

Blum New Wagner Representative in New York

The Detroit firm of *Wagner Brothers, Inc.*, will be represented in the New York State area by *Don C. Blum* of Rochester. As state distributor of the company's line of plating, polishing and buffing supplies and all types of plating equipment, he will draw upon his past four years of experience as a sales and service engineer. Prior

Don C. Blum

to that, Mr. Blum was in charge of plating and metal finishing for a period of six years at Rochester Products. He is well known in the field through his membership and several offices which he has held in the Rochester Branch of the American Electroplaters Society. Mr. Blum's offices will remain at 322 *Genesee Parl Blvd., Rochester.*

Dow Chemical Moves Industrial Applications Lab

The Industrial Applications Laboratory of *The Dow Chemical Company* moved from Ann Arbor, Michigan, to new and larger quarters in Bay City, Michigan, on May 16.

Laboratory Director *Dr. O. C. Cessna*, his assistant, *Edward O. Ohlmann*, and six other key employees made the shift, while several technicians will be added locally to bring the staff back up to its normal complement.

The new location affords some 10,000 square feet of floor space, approximately four times that formerly available, and will permit more effective operation and the use of larger scale equipment.

The laboratory had operated in Ann Arbor for about ten years under the name "Ann Arbor Laboratory" on investigational work chiefly concerned with the industrial application of Dow materials.

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99.75% PURE

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The experience of their engineers covers the operation of automatic and semi-automatic buffing machinery, polishing and buffing lathes, and abrasive belt operations. They have a full knowledge of proper selection of wheels, composition, and spindle speeds, and a willingness to help in your shop without obligation or cost. A request to the above address will bring one of these production experts to your immediate aid.

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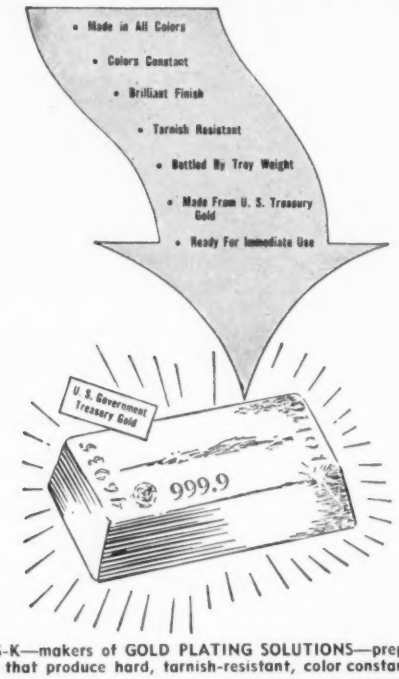
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DAVIS-K—makers of GOLD PLATING SOLUTIONS—prepared in all colors that produce hard, tarnish-resistant, color constant deposits.

Compounded from U. S. Treasury GOLD and highest (C.P.) chemicals. Sold by troy weight—certified 100% gold content.

Solutions are simple to operate and maintain.

We are fully equipped to reclaim your old gold, rhodium and silver solutions. Also wires or racks that have been used for precious metal plating.

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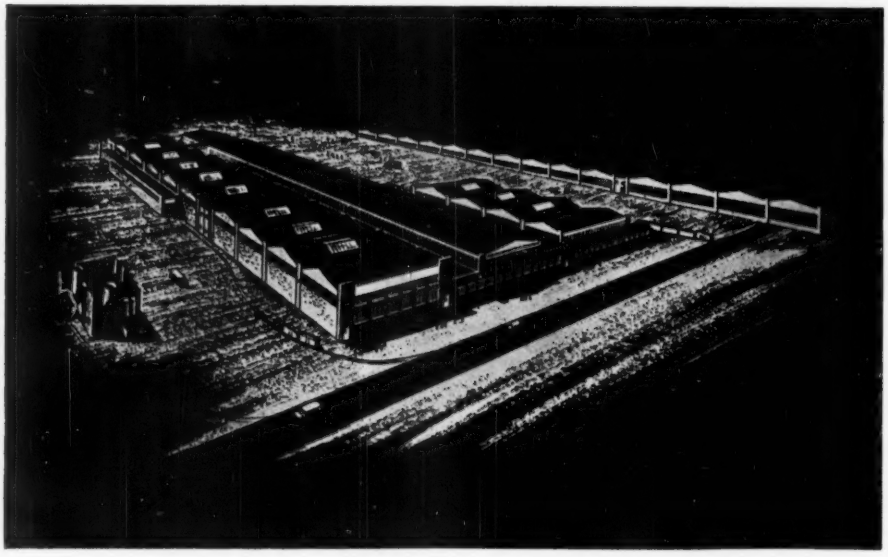

New Plant of Coated Products Division of the Carborundum Co., Wheatfield, N. Y.

Sulfur Products Co. Appoints New Distributor

Sulphur Products Co. of Greensburg, Pa., through the president, *Mr. Wilfred S. McKeon*, announces the election of an exclusive southeastern United States distributor. He is *Mr. C. H. Hohner*, Box 369, Atlanta 1, Ga. "Clem," as he is familiarly known in the South East, will give all required attention to plating problems on zinc plating, tin stripping, copper stripping and copper oxidizing.

New York Contract Plating Operations

The latest Bulletin of the Masters Electroplating Ass'n shows a rate of operation of 46% for 66 members firms for the week ending May 21, 1949. This compares with a figure of 50% for the same period last year. This is one of the slowest business periods faced by the local job plating shops in a number of years. One more robbery and an attempted robbery of New York job plating shops were added to the long list of already perpetrated similar crimes.

Michigan Buff Co. Opens Chicago Branch

It was recently announced by the *Michigan Buff Co.*, of Detroit, Mich., that a branch office and supply service center has been opened in the Chicago area. Formerly the Herbert Supply Co., the new office for Michigan Buff Co. is located at 1906 *Elston Ave., Chicago* 22, *Ill.*

The new office is under the management of *O. R. Herbert* and carries a complete line of polishing and buffing supplies and abrasive belts for the metal finishing industries. Assisting Mr. Herbert in both sales and service at the new Chicago office is *Mr. Donald Sheldon.*

J. R. Davies & Associates Purchase Dearborn Industrial Mfg. Co.

It was recently announced that the firm of *Joseph R. Davies and Associates* located at 302 *N. Halstead St., Chicago* 6, *Ill.*, specialists in the manufacture of patented sisal buffs sold under the trade name "Joe-D," have purchased the *Dearborn Industrial Mfg. Co.*, a corporation manufacturing

all types of cloth buff and polishing wheels, located at 5049 *Ogden Ave., Cicero 50, Ill.*

Mr. Davies, new president of the Dearborn Industrial Mfg. Co., announced that there would not be any changes in the operating personnel of either firm and that the Dearborn Industrial Mfg. Co. will continue to operate as a separate unit. *Mr. Russel W. Cuthbert*, former president of Dearborn Industrial Mfg. Co., continues as a director, but will be inactive in the management of the firm.

The purpose of combining these two organizations was to lower production costs by eliminating duplicate operating expenses, and thereby maintain the high quality of the products manufactured by both firms in a competitive market.

Pascoe Joins Research Lab at Atlas Mineral Products

Mr. Walter Pascoe, a recent graduate of Penn State College, has accepted a position in the Research Laboratory at *The Atlas Mineral Products Co.*, at Mertztown, Pa.

Hooker-Detrex to Build Trichlorethylene Plant

To help meet the heavy industrial demand for trichlorethylene as a metal cleaning and oil-extraction solvent, a new manufacturing plant is going to be built in Ashtabula, Ohio, by *Hooker-Detrex, Inc., Niagara Falls, New York*, at a cost in excess of 1½ million dollars. It is planed to have the plant in operation early in 1950.

Hooker-Detrex, Inc., which is owned jointly by *Hooker Electrochemical Company, Niagara Falls, N. Y.*, and *Detrex Corp., Detroit, Mich.*, built and placed in operation in 1947 a trichlorethylene manufacturing plant at Tacoma, Washington, to supply the west coast demand for the product. The operation of these subsidiary plants is under the supervision of the Hooker Electrochemical Company, and Detrex Corporation has contracted to market their entire output.

Leeds & Northrup Celebrates 50th Birthday

To celebrate the beginning of its 50th anniversary, the *Leeds & Northrup Co.* played host to 3500 employees and their guests at a dinner, entertainment, and dance in Convention Hall, Philadelphia. The company is an internationally known manufacturer of electrical measuring instruments, automatic controls, and heat treating furnaces.

Immediately after the turkey dinner *C. S. Redding*, president of the company, greeted the assemblage on behalf of the company. His talk centered on the vision and achievements of *Morris Evans Leeds*, founder of the company and now chairman of the board.

Following the presentation of a gold 50-year service placque to Mr. Leeds, he received a bound testimonial expressing the organization's esteem for its founder.

The testimonial was presented to Mr. Leeds jointly by *Robert Craig*, president of the Leeds & Northrup Co-operative Association, *J. H. Swope*, president of the Leeds & Northrup Employees' Union, and Mr. Redding. The ceremony symbolized the cordial and co-operative spirit which has always existed at Leeds & Northrup.

The party then continued with a minstrel show given by the employees, and the balance of the evening was devoted to dancing to the music of two orchestras.

Rosin to Represent Barnstead in Cleveland

Mr. Ira Rosin, of 3751 Prospect Ave., Cleveland 15, O., has been appointed as sales representative in the Cleveland territory for The Barnstead Still & Sterilizer Company, of Boston, Mass.

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LOW Production COSTS
USE
HEIL
LEAD ANODES
HEIL SAWTOOTH
THESE BUILT-IN FEATURES GIVE YOU LONGER LIFE AND MORE EFFICIENT OPERATION
• HOMOGENEOUSLY ATTACHED HOOK
Perfect metallic contact.
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Heavy center rib section.
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Angular cross-section for strength.
• MAXIMUM THROWING POWER
Multi-edge faces.
• DENSE UNIFORM STRUCTURE
Uniform corrosion.
• CHOICE OF (1) THICKNESS ½", 1", 1½",
(2) ANY STANDARD ALLOY
(3) HOOK SIZE AND STYLE
Optional ... A Plastic Coating on the hook in addition to the standard lead coating. This plastic is resistant to chromic acid spray and drag-out. The cost of this extra feature is small, and the coating increases anode life, therefore further lowering production costs.
Send your anode specifications to Heil for complete information.
Investigate HEIL Complete Manufacturing Service ... Tanks, Linings, Tank Heating Units for ALL Metal Finishing Processes.
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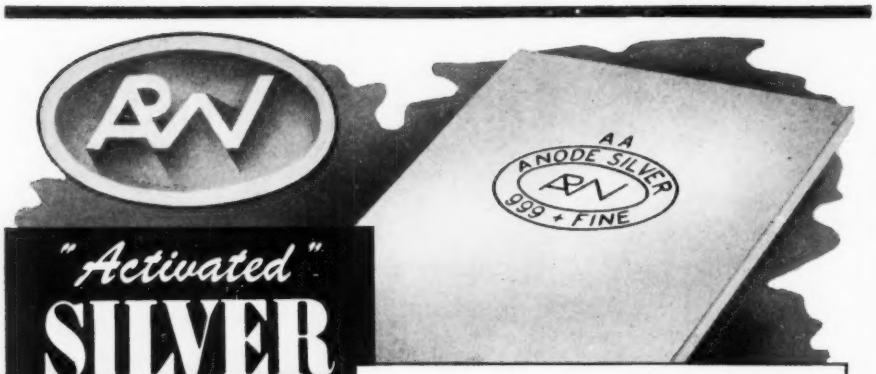
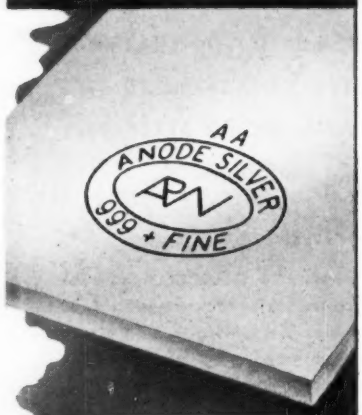


"Activated"
SILVER ANODES



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SAVE 4 WAYS

Users say our "AA" anodes produce a larger amount of finished work due to:

1. The large reduction in the amount of rejects of finished goods. Less stripping.
2. Full use of the anode (no lace or herring bone formation). Less scrap.
3. Uniform dissolution of the anode, thereby maintaining a nearly constant anode area, facilitating computation of effective surface (of particular interest to larger plants).
4. Cleaner, brighter finished work.

IMPORTANT

Every anode lot is laboratory tested and guaranteed to give complete satisfaction under normal conditions.

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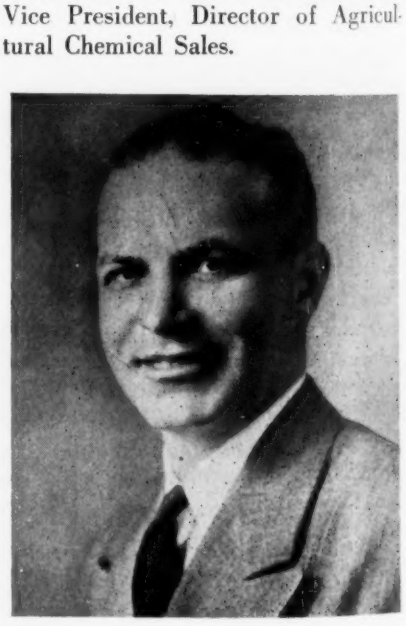
Visual Teaching Aids in Fundamentals of Electricity

A total of 888 individual teaching pictures comprise a series of 12 discussional-type slidefilms on Basic Electricity now available. They are designed for everyday use by instructors in the school, shop, for apprentice training, and for foreman's meetings in the electrical, electronics and allied fields.

The 12 films provide material for the instructor in the form of photographs, drawings and diagrams. Subjects included are: Magnetism (56 pictures), Static Electricity (91 pictures), Current Electricity (73 pictures), The Electrical Cell (46 pictures), The Storage Battery (101 pictures), Electromagnetism (56 pictures), The Generator (80 pictures), Alternating Current (85 pictures), Electric Motors (70 pictures), Electric Meters (81 pictures), Applications (Part 1, 63 pictures), Applications (Part 2, 74 pictures). For details, write to *School Service Department, The Jam Handy Organization*, 2821 *E. Grand Blvd., Detroit* 11, *Michigan.*

Mathieson Makes Sales Changes

Mathieson Chemical Corp. announces changes in its Sales Department Executive Staff as the result of the retirement of *E. E. Routh*, Vice President and Director of Sales. *D. W. Drummond* has been named Vice President, Director of Industrial Chemical Sales and *S. L. Nevins* has been named Vice President, Director of Agricultural Chemical Sales.



D. W. Drummond

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S. L. Nevins

Other appointments are as follows: *J. O. Logan* becomes Sales Manager, Industrial Chemicals; *R. J. Quinn*, Assistant Sales Manager, Industrial Chemicals; *L. P. Thomas*, Southwestern Sales Manager, Industrial Chemicals; *J. S. Whittington*, Sales Manager, Agricultural Chemicals. Mr. Thomas will be in Houston, Texas, and Mr. Quinn and Mr. Whittington will be in Baltimore, Md. All others will be located in Mathieson's executive offices.

O'Brien New Asst. Sales Manager for Klem Chemicals

Mr T. Curtis McKenzie, President of Klem Chemicals, Inc., Dearborn, Michigan, recently announced the appointment of *J. M. O'Brien* as Assistant Sales Manager. Mr. O'Brien was formerly Southwestern Division Manager for the Diversey Corporation with offices in Kansas City. He brings with him over eleven years of experience in the chemical cleaning fields. He will assist *Mr. A. J. Pettit*, General Sales Manager, in the company's plans for further expansion in industrial metal cleaning, as well as other industries not previously covered.

Williams Receives Honorary Degree

In recognition of significant contributions in the fields of science and public service, *Clyde Williams*, director of Battelle Institute, Columbus, Ohio, received the honorary degree of Doctor of Engineering at recent commencement ceremonies of the Michigan College of Mining and Technology, Houghton, Michigan.

These parts shown above are zinc alloy die-castings of a Radio Control Case and Cover, cleaned by the PERMAG process. The photographs from which the cuts were made were unretouched.

Is your job shop *troubled* when cleaning DIE-CASTINGS?

Although developed for cleaning a certain class of work, this Specialized—

PERMAG COMPOUND

was also found to do a FAST, thoroughly COMPLETE cleaning job on DIE-CAST PARTS regardless of the type or the soil conditions.

One tank used for all work.

PERMAG is ECONOMICAL — Operating at only 2 to 3 ounces per gallon, and at temperatures from 170 to 190 degrees Fahr.

PERMAG is FAST IN ACTION— Only 15 to 50 seconds cleaning time in a small cleaning tank provides plenty of work for a big plating tank.

Both large and small job shops find PERMAG to be the ideal Compound for cleaning the most intricate Die-Castings. Glad to send more details and discuss Die-Cast cleaning with you.

Write or 'phone.

Magnuson Products Corporation

Mfrs. of Specialized Cleaning Compounds for Industry

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Best Results.. Lowest Cost

ON ALL TYPES OF

TANK LININGS

Years of experience qualify us to handle your specific problem . . . involving the handling of acids, alkalis, aromatic solvents, unsaturated vegetable oils, gases, vapors, etc. Engineered recommendations of Laybond Rubber, Hard Rubber, Neoprene, Koroseal, Phenolics or Ceramics. Our specialized applications include racks and hangers, anodes, pickling tanks, drums, pails, dippers, pipe and fittings, air agitation systems, tank grids and screens, coils and ventilation equipment.

REPRESENTATIVES WANTED . . . plating supply houses . . . acid and chemical companies preferred. A few select areas available. Write for details.

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*PORTABLE RIGS FOR FIELD WORK

Sturgis Product Co. Changes Firm Name

The Sturgis Products Co. of Sturgis, Mich., manufacturers of barrel finishing equipment and supplies, and developers of barrel finishing methods, announces that effective July 1st, 1949, the firm will be known as the *Roto-Finish Company*. In addition to the change in name, the firm will move all its sales and manufacturing activities to its new plant in *Kalamazoo, Mich.*, at 3600 *Milham Road*. The organization and personnel of the firm will remain unchanged, the change in name being solely to make it more descriptive of the activities of the company, according to the firm.

Meaker Celebrates 50th Anniversary

The Meaker Co., Dept. MF, 1635-*S. 55th Ave., Chicago* 50, *Ill.*

Starting as the first electrogalvanizing job shop in Chicago, in 1899, the Meaker Co. has completed fifty years of service to the electroplating industry. The story of the growth and developments of the firm is told in a bulletin "Over The Years" recently published. A demand from other manufacturers for electrogalvanizing equipment that could be installed in their own plants led the Meaker Co. in 1906 to enter the equipment field, and today their line of completely automatic plating units is widely known throughout the world. Along with the development of machines went the improvement in the zinc electroplating bath originally used, so that greater plating speeds and closer uniformity of deposits could be achieved. A reading of the above bulletin will reveal a number of "firsts" by this pioneer firm in the electroplating field. Copies are available on request.

Northwest Salesmen Have New Sample Case of Metal Cleaners

A sample case for carrying all products that are in general use, together with equipment for their control, has been introduced by *Northwest Chemical Co.*, 9310 *Roselawn Ave., Detroit* 4, *Mich.*, for demonstrating their line of industrial metal cleaners. There are liquids and powders, some for use individually, others in combination, to get the correct pH for the type of soil being removed. "Our men have always carried samples, but now with this equipment," says *H. J. McCracken*, president of the company, "we know they have enough to work with, right on the job, to make a correct recommendation as to the product or products to use, as well as handle the installation and set up the control."

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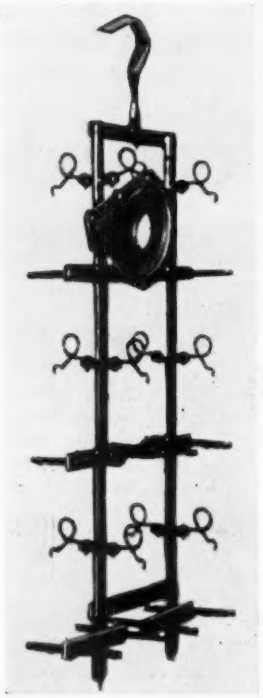
NARACO

* PAT. PENDING

Precision-made racks designed specifically for your work is a service rendered by National Rack to the electroplating field. You can bring us your problems with confidence since our technical staff are specialists in rack design. All Naraco Racks are equipped with NARACO*, the engineered, replaceable work holder, and are covered with a special rack insulation that withstands all types of plating and cleaning baths. Ten days to 2 weeks delivery.



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On practically every type plating solution

A long and varied list of cost-minded platers are producing finer finished plated work and savings in time and labor with the help of an Alsop "*Sealed-Disc*" Filter. Here's positive, trouble-free filtration that's proof against all dirt, dust, oil sludge and even invisible impurities usually present in plating solutions. Regardless of the size or type of installation, there's a "Sealed-Disc" Filter to "fit your job"—write for complete information or contact your regular plating supplier. Alsop Engineering Corporation, 407 Bright Street, Milldale, Conn.

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Filters, Filter Discs, Pumps, Tanks, Mixers, Agitators

Dr. Fritz, Pioneer in Rubber-Lined Equipment, Receives Medal Award

Dr. Howard E. Fritz, vice president-research of *The B. F. Goodrich Company*, has been named 1949 winner of the Lamme Medal of Ohio State University, it is announced by *Howard L. Bevis*, university president. The award is made yearly to a graduate of an Ohio State technical department for "meritorious service in engineering of the technical arts."

In its announcement, the university said that Dr. Fritz, one of the best known technical men in the rubber industry, is credited with leading the country in the development of rubber products for specific needs in the chemical engineering industries. He pioneered in the adoption of rubber-lined steel products as chemical engineering tools for the handling of corrosive liquids and won international fame through working with chemical engineers throughout the world in solving the problem of handling corrosive materials.

Pennsalt Forms New Sales District for Special Chemicals

Formation of a new sales district encompassing New York, New Jersey, Eastern Pennsylvania, Maryland and Delaware to provide more efficient service by its Special Chemicals Division, has been announced by *Pennsylvania Salt Manufacturing Co.*

The new territorial arrangement, know as the Philadelphia District, became effective June 1, according to *Joseph J. Duffy, Jr.*, manager of sales of the division. It comprises the present New York state, Newark, Philadelphia and Baltimore territories.

Horace F. McIntyre, Philadelphia representative for the Special Chemicals Division, has been appointed district sales manager, Duffy announced. *J. W. Beaver*, Baltimore representative, has been transferred to the Philadelphia territory.

O. A. Stocker Appointed Manager of Ruffert Chemical Co.

Mr. O. A. Stocker, former Technical Director of the Seymour Mfg. Co., Seymour, Conn., and one of the best known authorities on bright nickel plating the country, has recently been promoted to General Manager of the *Ruffert Chemical Co.*, a subsidiary firm of the Seymour Mfg. Co., Ruffert

O. A. Stocker

Chemical manufactures nickel catalyst flakes, widely used in the hydrogenation of oils.

Mr. Stocker is a graduate of the Univ. of Michigan, and started in the

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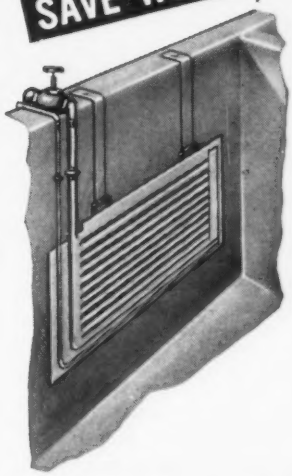

• You no longer need to use expensive bulky pipe coils to heat or cool tank solutions. The Udylite PLATECOIL will heat or cool efficiently and economically. PLATECOILS are made by joining two embossed steel plates to form channels for steam, hot water or coolants. They give more rapid heat transfer than pipe coils—are easier installed—cost you less. Available in three metals and two styles—fit into practically every size and type of tank. Write for further information.

• Higher BTU Capacity Per Square Foot of Area
• Smaller Coil Space—Greater Tank Capacity
• All Welded Seams and Joints
• No Pipe Threads in Solution
• Lower Maintenance and Initial Costs

THE Udylite CORPORATION
DETROIT 11, MICHIGAN

plating field in 1927 with the old Dodge Bros. Corp., later taken over by Chrysler. His principle work there was in chrome plating. After that he was associated with Bohn Aluminum and Brass Co. as electrochemist and later Ass't Chief Metallurgist, leaving there in 1937 to join the Seymour Co., where he was very active in developing their bright nickel plating bath. Mr. Stocker will remain in a supervisory capacity with the Bright Nickel Dept. of Seymour. Active direction of the latter department will be taken over by *Mr. Emil Fischer*, who was Mr. Stocker's assistant for several years.

Dow Removes Royalty Fees for Magnesium Plating Process

The *Dow Chemical Company, Midland, Mich.*, paved the way for broader use of electroplated magnesium products by announcing the removal of all royalty fees from the plating process it brought to commercial development recently. (See *Metal Finishing*, July 1948). The only stipulation of the new license arrangement is that Dow be permitted free access to any process improvements which may be made by the licensee. This royalty-free license is applicable in the United States only.

The electroplating process is one that will have a far-reaching effect on the utilization of magnesium, because it offers an easy and practical method for plating. Simple immersion of mechanically and chemically cleaned magnesium parts in a zinc salt bath is the only extra treating step necessary, after which the standard electroplating baths in common use on other metals can be used.

Urban New Sales Manager for U. S. Rubber

Appointment of *F. M. Urban* as sales manager of engineered rubber products and *H. Leon Moran* as factory manager, Fort Wayne plant, *United States Rubber Co.*, was announced today by *Ernest G. Brown*, vice president and general manager of the mechanical goods, general products, Lastex yarn and rubber thread divisions of the company.

Mr. Urban is a veteran of 20 years service in the rubber industry. He joined the company in 1929 as a salesman in the company's Chicago office, specializing in industrial rubber products, and in 1935 he was named assistant district sales manager in the Chicago office. Four years later he was named assistant sales manager for all branch sales in the company's mechanical goods division. In 1946 he became merchandise manager for the division, a position he held until his present appointment. In his new capacity he will make his headquarters at the company's Fort Wayne, Ind., plant.

Mr. Moran joined U. S. Rubber in 1922 as a laboratory assistant in the company's plant in Cleveland, Ohio. He progressed through various production positions until 1939 when he was made a divisional superintendent at the company's Passaic, N. J., plant. In 1945 he became general superintendent of that plant and in 1946 he was named manager of engineered rubber products at the newly acquired Fort Wayne, Ind., plant of the company.

for high speed
ALKALINE TIN PLATING
POTASSIUM STANNATE

With Potassium Stannate you can speed up your electro-tin-plating . . . increase your output from present plating equipment . . . lower your costs per article plated.

Potassium Stannate has higher conductivity . . . operates at increased cathode current . . . possesses excellent throwing power . . . all of which mean speedier deposition. It is flexible in use and may be employed with little or no change (except for higher currents) in your present procedures.

Recent changes in government restrictions now permit additional uses for tin plating. Investigate Potassium Stannate and the advantages it offers for both new and existing applications. Write for further information.

METAL & THERMIT CORPORATION
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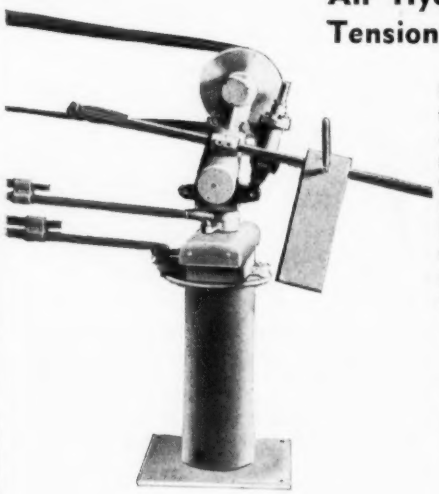
Producers of Potassium Stannate, Sodium Stannate, Stannous Sulphate, Stannochlor and other Tin and Antimony Chemicals

The NIEDERST COMPANY

Manufacturers of Back Stand Idlers designed for faster-smoother polishing plus versatility. Now available with Air Hydraulic Belt Tension Control.



Backed by eighteen years experience in the abrasive polishing field, the NIEDERST BACK STAND IDLER offers the utmost in both dependability and productiveness.

Write for Specification Sheet and information for introducing belt polishing on your present lathe equipment.

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525 W. 76 St., Chicago 20, Ill.

American Branch of Tin Research Institute Formed

Mr. John Ireland, Director, Tin Research Institute, London, England, announces the formation of *Tin Research Institute, Incorporated*, an American corporation devoted to provding free technical service to consumers of tin in the United States. The office of the new corporation, located at 492 *West Sixth Avenue, Columbus* 1, *Ohio*, will in the future handle all inquiries or requests for technical service, while a sponsorship will be maintained at Battelle Memorial Institute to handle new researches.

Technical experts are available for consultation and practical assistance either at the Tin Research Institute or at the consumers' plants.

A wide range of publicaitons covering every important use of tin is availabel free of all charges. Inquiries are invited.

Mr. Robert J. Nekervis has been appointed Supervisor of Metallurgical Development and *Mr. Robert M. MacIntosh* has been appointed Supervisor of Chemical Development in the new corporation. Both have been associated with Battelle Memorial Institute for the last 8 years, and served as Assistant Supervisors in the Nonferrous Division handling problems related to tin.

The trustees of the new organization are *Mr. Clarence D. Laylin, Dean Charles E. MacQuigg*, and *Dr. Bruce W. Gonser*, all of Columbus, Ohio.

News from California

The first plating demonstration by television on the Pacific coast will be on the program which The Los Angeles Branch has arranged for this fall over a Los Angeles television station. The demonstration is being made possible through the collaboration of Los Angeles Chapter, American Chemical Society, which offered to turn over to Los Angeles Branch of the A.E.S. one of its regularly sponsored half-hour periods for the purpose of presenting an actual plating shop demonstration.

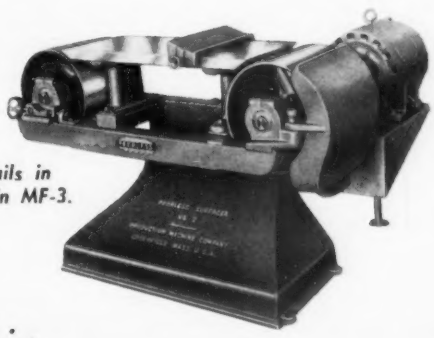
The American Chemical Society has made it a practice to invite allied technical groups to appear on its regularly sponsored television periods to present industry demonstrations as educational features that will afford the television audience visual conceptions of industry techniques, practices and methods of operation.

The chemical group's offer was conveyed to the Platers' Society at the latter organization's June 8 meeting by *Harold Kroesche*, who declared it to be a rare opporunity to publicize the plating and finishing industries to the Southern California public. The Branch approved the idea unanimously and authorized Kroesche to complete arrangements.

It is the plan of Los Angeles Branch to set up an actual plating shop on the stage of the television studio. The shop is to be equipped as completely as studio space facilities and requirements of the demonstration indicate. Members of the branch are to be asked to supply the equipment in the form of tanks, motors, rectifiers, solutions, racks, etc. Complete details of the program have not yet been developed. It was announced, however, that the program will be designed to give the television audience an overall concep-

Peerless FOR FAST STRAIGHT GRAIN FINISHING

Built in 9", 14" and 20" belt widths, and in horizontal or vertical types, Peerless Surfacing Machines give high speeds and fine finishes on any material that can be polished or ground. Belts may be changed instantly, so that a variety may be kept on hand for all classes of finishing. In many cases, a rapid cut on a Peerless Machine may replace a costly machining operation. For rapid, uniform, straight grain finishing, use Peerless Surfacing Machines.



Write for details in illustrated bulletin MF-3.

Production MACHINE COMPANY GREENFIELD, MASSACHUSETTS, U.S.A.

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SOLE PRODUCERS OF

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tion of the operation of a plating shop and the tpyes of techniques, problems and processes which are involved in the business of electro-plating.

To bring the message home to the average home owner more convincingly on his or her own level, it is believed that the committee in charge will select for items to be plated on the television stage objects with which the average television fan is familiar. It is felt that the educational advantage of the program to the plating industry as a whole, will be emphasized most convincingly if the audience can be shown the number and type of operations, and how they are actually performed, which are involved in the finishing of a simple household article, such as a pan, doorknob, hinge, refrigerator panel or piece of cutlery.

As the plating demonstration proceeds on the stage, a commentator will explain the successive operations of precleaning, dipping, drying, pickling, buffing and polishing, to the point where a completed piece of household ware, gleaming brightly, can be shown.

Metal Fabricators, Inc., has erected a new 5,000 square foot warehouse at 2971 *Partridge Ave., Los Angeles.* The firm is a manufacturer of miscellaneous sheet metal items.

Mr. and Mrs. Stanley Rynkofs (Liberty Plating Co.), and their two children left Los Angeles in mid-June for a two months' vacation motor tour. They motored first to the Pacific Northwest, then eastward to Devil's Lake, N. D., where Mrs. Rynkofs and the children visited her parents while Stanley went on to the A.E.S. convention in Milwaukee. After the convention he rejoined the family in Devil's Lake for the return motor journey to Los Angeles via Denver, Ogden, Salt Lake City and Las Vegas.

The *Westinghouse Electric Corp.* has announced the following transfers in West Coast executive personnel: *Walter G. Wilson*, manager at Los Angeles for the past six years, transferred to Phoenix, Ariz., and succeeded as Los Angeles manager by *Stanley M. Johns*, until recently Salt Lake City manager for the company. Johns is succeeded in the Salt Lake managership by *H. B. Hodgins*, formerly Westinghouse's Spokane, Wash., manager. *Robert E. Blasen* becomes manager at Spokane, succeeding Mr. Hodgins.

Recently elected new officers of the Los Angeles Chapter, American Society for Metals are: Chairman, *Benjamin Morey*, International Nickel Co.; Vice-Chairman, *Orrin Andrus*, of the O. A. Smith Corp.; *W. J. Parsons*, Pacific Scientific Co., secretary; and *J. R. Patterson*, Cook Heat Treating Co., treasurer. New directors include *F. L. Stamm, R. A. Schaus, B. B. Moss* and *O. E. Brown.*

NEW BOOKS

Journal of the Electrodepositors Technical Society

Published by the Electrodepositors Technical Society, 27 Islington High St., London N1, England. Price 2 Guineas, plus postage.

This bound volume of the papers given before the various meetings of

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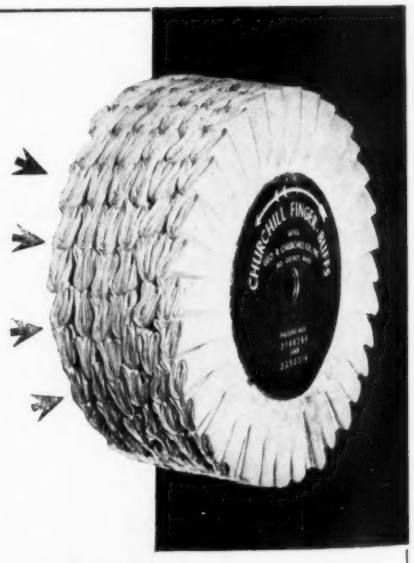

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the Society throughout the past year also contains the discussions following their presentation. The following articles are included:

Danger of Masked Pores and Methods for Their Determination, by *G. E. Gardam.*

Electroformed Molds for Plastics and Die-Castings, by *P. Spiro.*

Plating Shop Layout, by *A. W. Wallbank.*

Lead Plating Bronze Bearing Surfaces for High Pressure Pumps, by *H. Silman* and *M. F. E. Fry.*

An Analysis of the Polishing Problem, by *W. H. Sawyer.*

Automatic Polishing, by *H. C. Clements.*

A review of Metal Polishing, by *L. Mabel.*

Polishing—Its Role in the Metal Industry, by *W. L. Pinner.*

Jet Test for Thickness of Lead Coatings, by *R. A. F. Hammond.*

The Motor Car vs. The Weather, by *H. Silman.*

Bright Silver Plating, by *E. W. Wilson.*

Electrodeposition of Speculum, by *J. W. Cuthbertson.*

Practical Aspects of Speculum Plating, by *W. H. Sawyer.*

Plating Shop Construction and Equipment, by *H. E. Hutchinson.*

Bright Nickel Plating in the U.S.A., by *H. Silman.*

Review of Methods for Thickness Testing of Deposits, by *H. W. Egginton.*

Shear Tests for Adhesion of Chromium Plating to Steel, by *E. Zmihorski.*

Reduction of Polishing Costs, by *S. Wernick.*

Report of the Annual Meeting.

Presidential Address—The Relation of Electrodeposition to Electrochemistry, by *G. E. Gardam.*

Surface Active Agents

By A. M. Schwartz and J. W. Perry. Published by Interscience Publishers, Inc., 215 *Fourth Ave., New York* 3, *N. Y. Price* $10.00.

The chemistry and technology of these increasingly important materials is thoroughly covered in this 500 page volume. The book is divided into three sections; the first covers the methods of manufacture and synthesis of the various types of surface active agents; the second part discusses the properties, theories of their action, and evaluation; the third part discusses the many practical applications as well as many other possible uses for the materials. This latter part is divided according to the industry. An unusually complete author and subject index is helpful in ready location of material, and the numerous references cited throughout the text make it possible for the reader to pursue any particular subject diligently. While the text will be found very useful as a general treatise on the subject, electroplaters will find that the entire field of application of surface active agents to electrodeposition is only given two pages of coverage. Cleaning, Pickling, and Rust Inhibition are covered in another four pages. The references given under these headings will be found valuable, however.

W. A. R.

TECHNICAL LITERATURE

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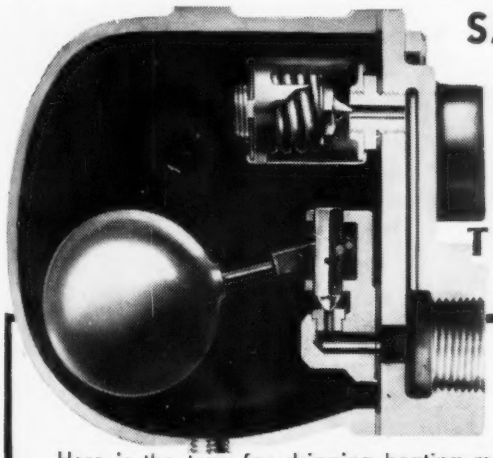
Published by the Ass'n of Consulting Chemists & Chemical Engineers, 50 *East* 41 *St., N. Y.* 17, *N. Y. Free.*

The twelfth edition of this Directory of consulting firms and the scope of



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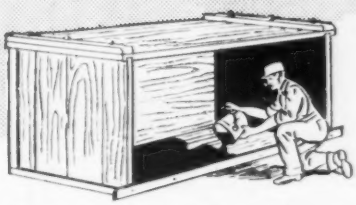

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Provides a lasting lining that withstands acids and caustics at room temperatures. A standby of Platers for over 25 years. Effectively protects wood or steel tanks. Easily applied in your own shop—just turn tank on side and fasten board on edge as illustrated. Then heat Belke Rubberite to 300° F. and pour over surface. Surfaces to be coated require no special preparation but should be reasonably clean.

When Rubberite cools, it has characteristics similar to soft rubber. Will not crack, scale, or run in the hottest weather. Write for complete information.

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activities of each firm has been divided into four sections, making for easier reference. By looking under the particular subject of interest, the reader can immediately find which consulting firms specialize in this field, and reference to this firm in another section gives a complete story on this firm's personnel, facilities, and specialized field. The bulletin should be valuable to anyone who may have a need for outside consulting work, as it enables one to contact the outstanding consultants in any particular field with a minimum of effort. Copies may be obtained free of charge by writing on your company letterhead, giving your source of reference.

Industrial Uses of Radioactive Materials

By Arthur D. Little, Inc., Cambridge 42, Mass. Free.

This thirteen page bibliography of the industrial applications of radioactive materials should provide researchers with fingertip information on the techniques and practical applications of tracers to the solution of industrial problems. The references are divided into special fields of application, such as the petroleum industry, mining and metallurgy, textiles, instruments, radiography, analytical, pharmaceutical, glass, and other miscellaneous applications. An introduction to the use of tracers outlines some of the problems involved in their use, and gives sources of information for safe handling of such materials. This booklet is available at no charge to persons requesting it on their company letterhead.

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

Los Angeles Branch

In its last meeting preceding the summer interlude of two meeting-less months, the Los Angeles Branch convened at Scully's Cafe, Los Angeles, on June 8th, with an attendance of 65.

President *Allan Sulzinger* presided at the initiation of three new members. These were *William S. Fernholz*, of the Wyandotte Chemical Co.; *Edward Price*, of the U. S. Spring & Bumper Co.; and *Alpha Green*, of Spence Plating Co.

A report by *Jack Bealle* indicated that the branch's ambitions of having the Supreme Society assign a research project to one of the universities in the Southern California area were were steadily drawing closer to materialization. Whether this will be the University of Southern California, California Institute of Technology, University of California at Los Angeles or Occidental College is not known at this time, Bealle reported, as he urged a stepping up of the work of resoliciting sustaining memberships in order that an adequate research fund can be built up.

The secretary read a letter received from *Manson Glover*, of The Boston Branch, chairman of the 1950 national convention, in which Mr. Glover sought Los Angeles Branch's support in an effort to have Supreme Society regulations relaxed as they pertain to the soliciting of convention funds. Mr. Glover pointed out that under ex-

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UNIVERSITY OF MICHIGAN LIBRARIES

isting rules, Boston Branch is prohibited from soliciting funds from supply houses for defraying convention expenses and will, therefore, have no money to turn over to Los Angeles Branch for 1951 convention purposes.

Announcement of the following committee appointments was made: *Peter B. Rogers* as general chairman of the branch's Educational Session to be held in March, 1950; and *Dexter G. Halldin* and *Ernest Fest* to head a committee named to arrange for the annual picnic. This will be held some time in August. Members will be advised by mail of date and location.

The educational session of the meeting was highlighted by a shop demonstration of the production of handwrought silver. The program was sponsored jointly by *Handy & Harman Co.*, and the *Allen Adler Silversmiths Co. H. A. Folgner* of the Handy & Harman Co., Los Angeles office, suppliers of silver anodes and compounds, prefaced a demonstration of silver craft work with some commentary on the uses of silver and its application in various industrial activities.

A demonstration of the art of the silversmith in creating a handwrought silver item was next given by Allen Adler of the Adler Silversmith Co., who is considered one of the outstanding silversmiths in the United States, in the field of handwrought silver.

With an anvil and auxiliary forming equipment, quenching baths and annealing facilities set up in the meeting hall, Mr. Adler proceeded to form a 6-inch high goblet, starting with a flat disc of silver six inches in diameter. The methods employed in gradually shaping the bowl to the specification sheet were shown on lantern slides which were described by Mr. Folgner as Mr. Adler worked at the anvil. Forming the handwrought goblet through its successive operations took 45 minutes, throughout which period the step-by-step processes were explained by Mr. Folgner as commentator.

Chicago Branch

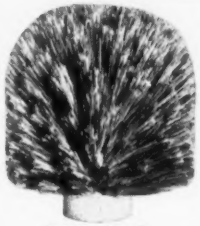
The speaker for the June 10th meeting, attended by 110 members and guests, was *Mr. J. R. Williams*, of Electric Products Company, who spoke on DC Power for the Plating Room. Mr. Williams' liberal use of slides contributed greatly to the presentation of the talk.

Throughout the talk Mr. Williams made numerous comparisons between rectifiers and motor generator sets. These comparisons involved initial cost, operating cost, efficiency, and features of construction and operation. While Mr. Williams' comparisons favored the motor generator set, it was brought out in the discussion at the end of the talk that there is a definite application for both rectifiers and motor generator sets, and all factors should be carefully considered and a comparison made before determining whether a rectifier or motor generator set would best fit the application under consideration.

The Branch welcomed the following, who were recently elected to membership: *William Murphy, Tony Balkonis, James Raby, Bernard Trainor, Robert Bernson.*

Those in attendance were treated to

DIXRIP
FINE WIRE SCRATCH BRUSHES



Goblet brush shown can also be supplied with 3½" long handles. Tapered arbor hole for direct mounting on tapered spindle. Made in diameters ⅞" to 6" of bristle or brass, steel or nickel silver wire.

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ELECTROCHEMICAL SOCIETY
Metropolitan Section

The May 19 Spring Dinner meeting of the Metropolitan Section was featured by a joint talk by *Drs. Henry B. Linford* and *Frederick A. Lowenheim* on the "Electrodeposition of Uncommon Metals." The meeting was held at the Hotel Holley, and dinner preceded the technical discussion.

According to the speakers, plating of the uncommon metals resolves itself into two problems; finding ways to deposit some of the unusual metals which have usable commercial properties, and finding commercial uses for unusual metals that can be deposited from known solutions. Cobalt and antimony are good examples of the latter case, while aluminum, tungsten, and several others are metals which should have wide commercial usage as electrodeposits if and when a commercially practicable method is developed for their deposition. The interest in this field was evident from the lively discussion period which followed the talks.

The election of officers for the coming year also took place at the business session of the meeting. Elected to office were the following:

Chairman—L. I. Gilbertson
Vice-Chairman—K. G. Compton
Sec'y-Treasurer—J. S. Mackay

Engineers Blame Atmospheric Conditions for Premature Dimming of Plated Trims

Automotive engineers attending the

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SAE Summer Meeting in French Lick Springs Hotel recently turned their attention to solving the problem of keeping the American automobile bright and shining. While the problem remained unsolved at the conclusion of the meeting's symposium on corrosion, the engineers learned that corrosion-prevention is dependent only in part upon the manufacturer, in part upon the car owner, and in large part upon atmospheric conditions in the region where the owner lives and the car is used.

F. L. LaQue and E. J. Hergenroether, of The International Nickel Co., New York, N. Y., said that corrosion in the form of rusting is to be expected; the wonder is that modern automobiles, because of materials, manufacture, and finish, rust so little and endure so long.

They said that tests have indicated that quick drying and air circulation help to prevent corrosion after a vehicle has been wet and that exposure to sun and wind are excellent deterrents. Salt products applied to highways for snow-removal purposes do not greatly increase corrosion, they added, and car owners can help to protect their vehicles by parking in such places as will permit cars to dry quickly and also washing them with sufficient frequency to remove the accretions.

By and large, they explained, venti-

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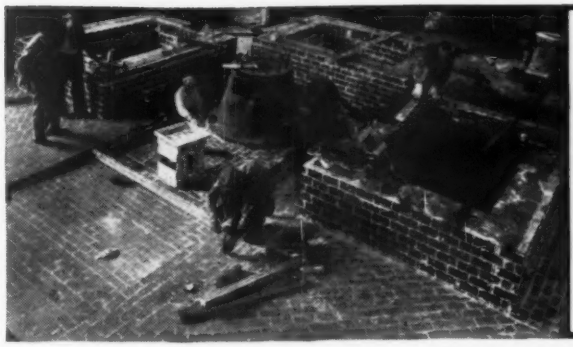

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lation and quick drying are essential to corrosion-prevention, quick and thorough drying being important not only through its direct effect in removing corrosive influences, but also in affecting the protective value of rust films forming on steel.

Prolonged tests now under way promise to reveal methods of protecting and preserving the brightwork on automobiles, and also the various other, if concealed, electroplated parts, it was reported by *H. A. Pray*, of Battelle Memorial Institute, Columbus, Ohio.

The decorative life of the parts depends in large degree upon where and how the coating is used, Mr. Pray explained, adding that heavy industrial atmospheres, such as at Pittsburgh, Pa., and seacoast environments appear to accelerate corrosion, although its rate is somewhat dependent upon the amount of nickel used in the plating. The thickness of the nickel, whether deposited directly upon the metal or over a copper undercoat, is highly important, he commented.

NATIONAL ASSOCIATION OF CORROSION ENGINEERS

Corrosion Short Course Scheduled

Short Course on Corrosion has been scheduled September 12-16 at University of Texas, Austin. The course is being sponsored by the *National Association of Corrosion Engineers*, Houston, and is directed principally to persons in industry who must deal with corrosion problems, but who have not had the experience or background to do so efficiently. *Dr. Norman Hackerman*, of the university faculty, is assisting officers of the NACE South Central Region in making arrangements for the course. Dr. Hackerman says the course will be useful as a refresher in the fundamental phenomena with which the corrosion of metals is concerned.

Applications for official registration blanks are being received by *A. B. Campbell*, Executive Secretary, National Association of Corrosion Engineers, 905 Southern Standard Bldg., Houston 2, Texas. Registration fee is $20.

Plan of Course

The plan of the course has been outlined as follows:

Nine two-hour lectures followed by discussion periods will be given. Two lectures will be devoted to background, such as considerations of pertinent aspects of thermodynamics, kinetics and electrochemistry.

The remainder of the lectures will be devoted to detailed consideration of corrosive process and corrosion prevention.

Experience and knowledge of authorities in several fields will provide the basis for recognition of corrosion types. Efficient prevention practices will be discussed.

Selected motion pictures paralleling or elaborating on the subject matter of the lectures and discussions are being considered.

Housing for 170 on the university campus has been made available. The cost per person per night for these accommodations will be $1.50. Rooms will be ready for occupancy Sunday, September 11 and must be released by noon, Friday, September 16. Registration fee for the course has been set at $20.

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